THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE MECHANIC ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

APRIL, 1826.

Self-regulating Reservoir, for Hydrogen and other Gases, as used in the Chemical Laboratory of the University of Pennsylvania, by R. HARE, *M. D. Professor of Chemistry, &c.*

The preceding figure, represents a self-regulating reservoir for hydrogen gas, (whether pure or sulphuretted;) or for nitric oxide, or carbonic acid gas.

This very perspicuous engraving, requires but little to be said in explanation of it. Suppose the glass jar without, to contain diluted sulphuric acid; the inverted bell, within the jar, to contain some zinc,

supported on a tray of copper, suspended by wires, of the same metal, from the neck of the bell. The cock being open, when the bell is lowered into the position in which it is represented, the atmospheric air will escape, and the acid, entering the cavity of the bell, will, by its reaction with the zinc, cause hydrogen gas to be evolved rapidly. As soon as the cock is closed, the hydrogen expels the acid from the cavity of the bell; and consequently, its reaction with the zinc is prevented, until there be reason for drawing off another portion of the gas. As soon as this is done, the acid re-enters the cavity of the bell, and the evolution of hydrogen is renewed, and continued until again arrested, as in the first instance, by preventing its escape, and consequently causing it to displace the acid from the interior of the bell, within which, the zinc is suspended.

This apparatus, in the same form as here represented, answers perfectly well, as a self-regulating reservoirof sulphuretted hydrogen; using sulphuret of iron instead of zinc. With pieces of marble and muriatic acid, it answers equally well for carbonic acid gas. To qualify it for nitric acid gas, in lieu of the copper tray and wires, a coil of copper may be suspended, by a platina wire, or by a glass tube having an enlargement, at the lower end, like a nail head.

The principle, of this apparatus, is analogous to that which was contrived by Gay Lussac. I had employed the same principle, however, when at Williamsburgh, to moderate the evolution of carbonic acid, before I had read of Gay Lussac's apparatus.

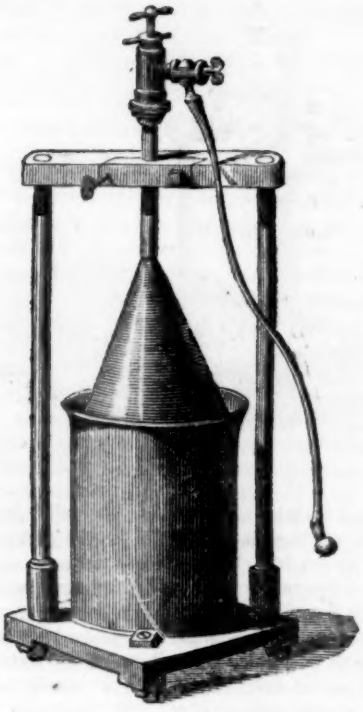
I prefer the modification, above described. In the first place, it is internally more easy of access, for the purpose of cleansing: secondly, it is much better qualified for containing sulphuret of iron, or marble, for generating sulphuretted hydrogen, or carbonic acid gas; and thirdly, by raising the bell glass, the pressure may be removed.

In the other form, the pressure on the gas is so great, that, unless the tube, the cock, and their junctures, be perfectly tight, there must be a considerable loss of materials; since the escape of gas, inevitably causes their consumption, by permitting the acid to reach the zinc, or other materials, employed.

Large Self-Regulating Reservoir, for Hydrogen, as used in the Laboratory of the University of Pennsylvania, by R. Hare, M. D.

The figure, (at the top of the next page,) represents a self-regulating reservoir, for hydrogen gas; it is constructed like that described in the preceding article, excepting, that it is about 50 times larger, and is made of lead, instead of glass.

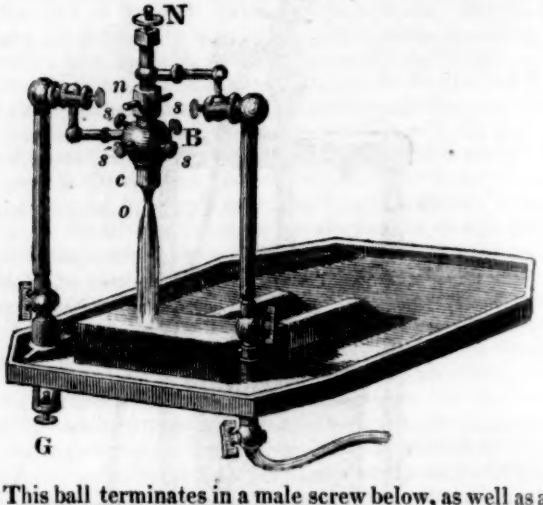
This reservoir is attached to the compound blowpipe, in order to furnish hydrogen; and may, of course, be used in all experiments, requiring a copious supply of that gas. When this is to be applied to the hydro-oxygen, or compound blowpipe, (figured and described in the next article) the knob at the end of the pipe, which has an orifice on one side, is placed under the gallows, (G) and fastened air tight to the pipe of that instrument, by the pressure of the screw of the gallows.



Engraving and description of a Compound Blowpipe used in the laboratory of the University of Pennsylvania, by its inventor, R. HARE, M. D.

The following figure represents a compound blowpipe, which I contrived and executed myself, about eleven years ago; but, fearing it might be deemed unnecessarily complex, I have never published any account of it. Experience has shown, that the complication of its structure, does not render it more difficult to use, than the simplest instruments intended for the same purpose; while its parts are peculiarly susceptible of advantageous adjustment.

B is a brass ball, terminating in a male screw above, and in a female screw below. The ball has a vertical perforation, which commences with the lower screw, and terminates with the upper one. Another perforation, at right angles to this, causes a communication with the tube, which enters the ball at right angles. A similar, but smaller brass ball, may be observed above, with perforations similar to those in the larger ball, and a tube in like manner entering it la-



terally. This ball terminates in a male screw below, as well as above; and the thread of the lower male screw is curved to the left, while that of the larger ball, which enters the same nut (*n*) is curved as usual to the right: hence the same motion causes the male screws to approach, or recede from, each other, and thus determines the degree of compression given to a cork which is placed between them, in the nut. At the top of the ball, a small screw may be observed, with a milled head. This is connected with a small tube which passes through a cork in the nut, and reaches nearly to the external orifice, from which the flame is represented as proceeding. This tube is for the most part of brass, but at its lower end, terminates in a tube of platina. Into the female screw of the larger ball, a perforated cylinder of brass, (*c*) with a corresponding male screw, is fitted. The perforation in this cylinder, forms a continuation of that in the ball, but narrows below, and ends in a small hollow cylinder of platina, which forms the external orifice of the blowpipe (*o*.)

The screws (s s s s) are to keep, in the axis of the larger ball, the tube which passes through it, from the cavity of the smaller ball. The intermediate nut, by compressing, about the tube, the cork, which surrounds it, prevents any communication between the cavities in the two balls. By the screw (N) in the vertex, the orifice of the central tube may be adjusted to a proper distance from the external orifice.—Three different cylinders, and as many central tubes, with platina orifices of different calibres, were provided, so that the flame might be varied in size, agreeably to the object in view.

I have always deemed it best, to transmit the oxygen gas through the tube in the axis; since two volumes of the hydrogen, being required for one volume of oxygen, the larger tube ought to be used for

the former: and the jet of hydrogen is placed between a jet of oxygen, within it, and the atmospheric air without.

Under the table, is a gallows, (G) with a screw for attaching a pipe, leading from a self-regulating reservoir of hydrogen.

Society for the Promotion of Internal Improvement, &c.

REPORT ON ROMAN CEMENT.

Letter of J. I. Hawkins, Esq. to Mr. Strickland, accompanying a report upon the manufacture of ROMAN CEMENT, &c.

London, Oct. 31st, 1825.

DEAR SIR,—I regret exceedingly, that circumstances against which I could not provide, have put it out of my power to make the inquiries on the subject of iron, which I contemplated, and which are necessary to the completion of my intended report upon the process of making iron and steel.

I have not yet been able, and I do not now see a very near prospect of being able, without injury to Messrs. Perkins & Co. to shift from myself the care of their concerns, and, therefore, cannot promise the Report in any given time, but it is my intention to complete it as soon as practicable, and forward it to you in Philadelphia; taking the chance of its containing so much information, not anticipated through other channels, as may entitle it to the favourable attention of the Society for which you act.

I have the pleasure, however, of herewith furnishing you with some samples of the stone, from which the Roman Cement is made, together with a description of the same, and of the mode of preparing the cement; which samples and description, I beg you to present to the Pennsylvania Society for the promotion of the Internal Improvement of the Commonwealth, as a small token of my cordial feeling for the interests of that state, in which I formerly spent several happy years, and within, or in sight of which, on the banks of the Delaware, I fully expect, and intend, to terminate my ramblings, in little more than six months from the present time.

I hope this packet may reach you in time for your embarkation, but if it should not, I shall request Messrs. Curwen & Hagarty, to forward it by the first opportunity.

I have sent small specimens, for the sake of making a small packet for you; but I have endeavoured to select such as will fully show the character of the stone.

Yours, &c.

JOHN J. HAWKINS.

W. STRICKLAND, Esq.

To the Pennsylvania Society for the Promotion of the Internal Improvement of the Commonwealth.

GENTLEMEN—From many years residence within the state of Pennsylvania, I feel strongly attached to the interests of the Common-

wealth, and am desirous of contributing any information toward its improvement, which more than twenty years of association with the principal engineers of Great Britain, and an extensive practice as an engineer in this country, have enabled me to acquire.

I therefore gladly accede to the request of Mr. Strickland, made me when he was lately in London, that I would furnish you with some specimens of the Roman Cement stone, together with my views, as to the situations, and circumstances, under which that most valuable production should be sought for.

I make this communication with the more confidence, that success will crown the pursuit, since I am informed that the stone has been found in the state of New York, in consequence of some specimens and advice, which I gave seven or eight years ago, to Mr. Canvass White, of Whitesboro', in that state, and that the cement made from that stone, was used in executing the locks of the New York canal. Nor do I forget, that in making an effort to promote the improvement of Pennsylvania, I am also aiming at the benefit of New Jersey, of which state I have been near thirty years a citizen; for I am well assured that the improvement of both states will go hand in hand.

The stone, of which the Roman Cement is made, is mentioned by Robert Jameson, in his System of Mineralogy, second edition, Edinburgh, 1816, vol. 2, page 195, as a variety of "compact, indurated marl," which he describes as a "ferruginous marl, in which the mass contains a considerable intermixture of oxide of iron. It occurs in spheroidal concretions, called *Septaria*, or *Ludi Helmontii*, that vary from a few inches, to a foot and a half, in diameter. When broken in a longitudinal direction, we observe the interior of the mass intersected by a number of fissures, by which it is divided into more or less regular prisms, of from three to six, or more, sides; the fissures being sometimes empty, but oftener filled up with another substance, which is generally calcareous-spar."

The same stone is described in William Phillips's Elementary Introduction to Mineralogy, third edition, London, 823, page 157, as "a variety of the Argillo-Ferruginous-Limestone," called "The Septaria (Ludus Helmontii) occurring in regular layers in the London clay."

In John Mawe's descriptive Catalogue of Minerals, fifth edition, London, 1825, page 29, the stone is classed as a variety of "clay-iron stone, containing veins of calcareous-spar, (septaria.")

In Andrew Ure's Dictionary of Chemistry, second edition, London, 1823, under the article "Cement," are given, three analyses of "Parker's Patent Cement," by Sir Humphrey Davy, by Loftus, and by Mulgrave, the average of which gives the constituent parts to be, in the nearest round numbers—

Of Silex, - - - - - - - -	23
Alumnina - - - - - - -	7
Oxide of iron, and Manganese,	12
Carbonate of Lime, - - -	55
Loss by heat, - - - - -	3
	100

The specification of the patent granted to James Parker, for the Cement, dated June 28th, 1796, is published in the Repertory of Arts, second series, vol. 18, No. 118, for May, 1811, page 330.

The stones described in the specification, are called "Nodules of Clay," and the invention is stated to consist in reducing to powder, certain stones, or argillaceous productions, called nodules of clay, and using that powder with water, so as to form a mortar or cement stronger and harder than any mortar or cement now prepared by artificial means. I do not know of any precise general term for these nodules of clay, but I mean by them certain stones of clay, or concretions of clay, containing veins of calcareous matter, having frequently, but not always, water in the centre; the cavity of which is covered with small crystals of the above calcareous matter, and the nodules agreeing very nearly in colour with the bed of clay in, or near which they are found. These nodules, on being burnt with a heat stronger than that used for burning lime, generally assume a brown appearance, and are a little softened; and when so burnt and softened, become warm, but do not slake, by having water thrown upon them, and on being reduced to powder after burning, and being mixed with water, just sufficient to make into a paste, become indurated in water, in the space of an hour, or thereabouts."

"The manner in which I prepare and compose this cement is as follows; viz. The stones of clay, or nodules of clay, are first broken into small fragments; then burnt in a kiln or furnace, as lime is commonly burnt, with a heat nearly sufficient to vitrify them; then reduced to a powder, by any mechanical or other operation, and the powder so obtained is the basis of the cement."

"To compose the cement in the best and most advantageous manner, I take two measures of water and five measures of the powder thus described; then I add the powder to the water, or the water to the powder, taking care to stir and beat them during the whole time of intermixture. The cement is then made, and will set, or become indurated in ten or twenty minutes after the operation has ceased, either in, or out of water."

To the information contained in the above extracts, I would add, from my own success in searching for the stone, and experience in using large quantities of the Roman cement, made from the stone found and manufactured in various and distant parts of this kingdom, the following important points.

1. That the stone is found scattered through a stratum of clay, sometimes in digging of wells or pits, but more abundantly, and with little labour, on the shores of the sea, or of rivers that wash the strata of clay.

2. That the stones which are found in wells, or other situations not wetted with salt water, make the cement of a paler colour, than those found on the shores of the sea, or of salt rivers.

3. That the stones found on the sea and salt river shores, make a cement, which on account of the salt, is apt to be disfigured, by the salt oozing out in patches from walls stuccoed with it, but that the salt does not hinder the hardness and durability of the cement.

4. That the stones found in different places, require a different de-

gree of heat, to make the cement of the best quality; but the proper degree will easily be ascertained, by a few comparative trials on the stone itself, when found.

5. That after the stone is burnt, it is easily broken into small fragments by means of stampers, and then reduced to flour by the ordinary mill-stones.

6. That no wet, nor even damp, must be suffered to come in contact with the cement after it is burnt, until the moment of using it, nor must it be much exposed to the air.

7. That the cement may be advantageously used with one half of its bulk of clean sharp sand, and that the sand ought to be well mixed in with the cement immediately before wetting it for use, and not earlier, lest the damp of the sand should destroy the setting powers of the cement.

8. No greater quantity of the cement must be wetted at one time, than can be used in a few minutes, and it must not be disturbed after it begins to set.

9. The test of the goodness of the cement, is, the setting as hard as stone, in from ten to twenty minutes, after being mixed with water enough to constitute a stiff mortar.

10. The cement made from some stones, will admit of being mixed thin enough to run into a mould, in the manner of plaster of Paris; but that made from other stones, will never harden if so much wetted.

11. The cement hardens quicker in damp than in dry situations.

12. The cement will adhere but very slightly to a coat of itself, previously laid on, and therefore it ought always to be laid on for stuccoing, from three quarters to one inch thick, in one coat, leaving an abrupt edge, against which the next mixing must abut.

13. The cement adheres very firmly to bricks, and to some stones, but the bricks must be wetted before being used, or they will absorb so much water from the cement as to prevent its setting.

Accompanying this paper, I send you eight small specimens of the stone, in order that the eye of those who may be induced to institute the search, may become acquainted with the appearance of the substance sought. One of the specimens, from its paleness and softness, appears to have been in a state of growth, when taken from its bed, and seems to warrant the supposition, that the stone is constantly forming in the beds of clay.

I have heard that a substitute for the above described stone, has been found in some other very poor iron-stones, but I have never seen any of the cements said to be made from them, nor have I heard any good account of such cements.

In the hope that the stone may speedily be discovered, and conduce to the promotion of the objects of your excellent institution,

I remain, Gentlemen,
Your warmly attached fellow citizen,
JOHN ISAAC HAWKINS.

London, Oct. 31st, 1825.

NOTE.—The specimens referred to in the foregoing report, are left with the publisher, (Mr. Dobson,) who will exhibit them to any gentleman who wishes to examine them.

Observations on the production of Sugar, as an appendage to common farming.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—You, in common with every man of observation, must have noticed the great alterations which, within a short period of time, have taken place in the circumstances and habits of society. Many articles, which, a few years since, were considered as luxuries, have now taken their station among the necessaries of life. If these are to be enjoyed, we must pursue the course which is necessary to their attainment. Labour, is the only means which nature has given to man for the procurement of either necessaries, comforts, or luxuries; and by her laws, this labour is productive, in proportion to the skill by which it is directed. The fabrics, worn by our sires, might still have answered the purposes of their descendants; but the improvements of Arkwright, Watt, and others, have so far facilitated the production of cloth, that what fifty years ago, would have been considered as articles of luxury in dress, are now in common use, and viewed as absolutely necessary. This change in the habits of society, is quite as remarkable in our food, as it is in our dress, our furniture, and other modes of living.

I wish at present, to call your attention, to the extraordinary increase of the consumption of sugar, which, in many instances, now forms a part of breakfast, dinner, and supper, even in the families of the poor. It is no uncommon thing with labouring people, to have tea with their dinners; and they argue that, as a beverage, it is preferable to beer or spirits, and equally cheap. To discuss the merits of this question, is not the object which I have in view, as any thing that either you, or I, could say, would have but little influence upon the habits of society; now-a-days, a pauper in the alms-house, gets tea once or twice a day: this, a century ago, was a luxury, which had to be secured to great ladies, by a clause in their marriage contract.

The revolution, is still going forward, which has brought people to live in better, and cleaner houses; and in its progress, it will undoubtedly cause some things heretofore considered as necessary, to be entirely relinquished, or very sparingly used; because they will be found to be incompatible, with the style, and quality, of other things about us. Of this class, we may instance tobacco, as its use in chewing, smoking, and snuffing, do not suit the cleanly habits, and the good furniture, which refinement is introducing into modern use. Elegant carpets, well-papered rooms, &c. are every day lessening the consumption of tobacco. The honours so well earned by *Arkwright*, by *Watt*, by *Fulton*, and by *Whitney*, will be equally due to that benefactor of the human race, who shall introduce into our style of living, something that will be a remedy for the consumption of alcohol. Perhaps increasing the quantity, and lessening the price of sugar, may, in some degree, aid in the discomfiture of the wretched habit, and obviate the evils consequent on the practice of drinking intoxicating liquors. Should we succeed in discovering some vegetable easily cultivated, and yielding a considerable portion of sugar, it may be the means of compensating the tobacco-planter, for the loss of his

customers. Those engaged in this branch of tillage, should begin to look around them, for some other employment, for their labourers and their lands; the current is now setting against the use of tobacco, and when once it is considered as disreputable to employ it, were it to be given away, more of it would be wasted, but not more used than now is, excepting among those who are poor, dirty, and ill lodged, like the peasantry of Ireland and Germany.

It is a general, but probably an incorrect opinion, that the sugar-cane, *saccharum officinarum*, and a tropical climate, are our sole dependance, for an abundant supply of sugar. It is true, that sunshine and heat, are essential to the production of vegetable oils, salts, resins, &c. but is equally true, that all these are produced throughout the whole temperate zone; and would it not be arrogant to say, that every discovery and improvement of which agriculture is susceptible, has been already made? Agriculture, like all other *arts*, when united to the *sciences*, will give results of which we, at present, cannot form any conjecture; and, I am convinced that the time will come, when sugar will be obtained from plants not at present cultivated for that purpose, and capable of being raised throughout an extent of country, not now supposed possible.

These observations were suggested by the following circumstance: late last fall, there had been some sharp frosty nights, succeeded by hot sunshiny days; on one of these, I noticed a vast number of flies, of various kinds, swarming about some bundles of broom-corn, *holcus sorghum*, that had been recently cut down; it was evident that they were allured by something in which they were much interested. I at first imagined that the heat and shelter, afforded by the stalks, had brought them together; but upon examination, no remarkable degree of warmth was perceptible; heat and shelter therefore could not be their object; food next occurred as the subject of their attention, and upon carefully examining the stems, I found that on twisting them hard, a table-spoonful of remarkably sweet juice, could be pressed from a single joint, near the bottom of the plant; this solved the inquiry respecting the object of the flies, and perhaps may lead to results of greater importance.

Cuttings from two or three of the lower joints were saved, for the purpose of having them completely pressed; but this, on account of their ripe state, their hard cane-like fibres, and my want of proper means, was found to be a difficult task. This delayed, for a few days, the completion of the experiment, and during this period, it was found, that the juice in the plant, had undergone the acetous, and putrefactive fermentations, which prevented the ascertaining the quantity, and quality, of the sugar, by evaporation, and crystallization as had been determined.

Considering that sugar is an article in increasing demand, that the daily improvements making in the old branches of agriculture, are reducing the profits of the farmer to a minimum, and that sugar, in smaller or larger quantities, is found in many vegetables; would it not be wise in our agriculturalists, throughout the Union, to make experiments upon the cultivation of sugar. The quantity contained in

broom-corn, convinces me that this plant is of sufficient consequence to command their attention, and to procure for it a general and careful trial. The thing is deserving of experiment, to the north as well as to the south. The plant grows in every state in the Union. It is probable that the advantage will be with those who have most heat and sunshine, provided the people are equally industrious, and have this industry under the guidance of equal skill and intelligence; for, in all comparisons of this kind, these must be taken into the calculation, as in many instances, they have power, to more than compensate, for some deficiency in natural advantages.

The improvement, and increase of all useful productions, are objects of national importance; and, perhaps, the editors of newspapers may think these hints worth disseminating. In this case, I hope that they will also aid in making your useful repository more generally known, by giving credit to the Franklin Journal of Philadelphia.

Yours, &c. SACCHARUM.

The foregoing remarks are from the pen of a gentleman, whose "eyes are in his head;" who is a careful observer of the works of nature, with a view to the application of her productions, to purposes of practical utility. In addition to the above, he has urged the propriety, of calling the attention of the agriculturist, to that important product, vegetable oil; the ground-nut, the seeds of white poppy, of sun-flower, of cotton, and many other plants, claim the attention, and promise to reward the labour of the husbandman. It is in the power of the editors of newspapers, to do much good, upon such subjects; particularly at a time when most of the productions of the soil, yield but little profit, and the farmer is, therefore, ready to listen to suggestions, which, in more prosperous times, would remain unheeded.—EDITOR.

Professor Renwick's Review of "An account of experiments to determine the figure of the Earth, by means of a pendulum, vibrating seconds in different latitudes, and on various other subjects of philosophical inquiry. By CAPTAIN EDWARD SABINE, F. R. S. &c."

(Continued from page 172.)

The method employed by the French philosophers, in operations of the same nature, at several points of the arc of the meridian, passing through France, and subsequently by Biot at Unst and Leith, is entirely different; and is the invention of Borda. He suspended, in front of an astronomical clock, a sphere of platinum, by means of a slender iron wire, whose length was about four times that of the clock pendulum; the wire was made of iron, in consequence of the great tenacity of that metal, which would permit it to be drawn of great fineness, without rendering the wire liable to break, by the weight of the ball: the coincidences of this wire, with a cross or mark upon the lens of the clock pendulum, were observed by means of a small telescope placed in front. After the pendulum was brought to rest, its extreme length from the point of suspension, to the lower surface of the sphe-

rical body, was measured, while it remained suspended; the distance between the centres of oscillation and suspension, or the effective length, was found by calculation, founded on well known formulæ, on the supposition that the wire was devoid of weight; and a correction finally applied for the weight of the wire. In this method, each observation is entirely independent of any other, and rests upon its own merits; whilst in the method, employed by Captains Kater and Sabine, in which the *relation* only is determined, which the length of the seconds' pendulum, at the station to which the pendulum of comparison is carried, bears to the length at the station of the fundamental experiment. The correctness of the *absolute* length at those stations will depend upon the accuracy of the original determination. But this need not be a disadvantage, even in determining the *absolute* length at the several stations, because the fundamental experiment may be frequently repeated, until perfect accuracy may be considered as attained; and certainly is none, in the application of the results to the deduction of the figure of the earth: because in such case it is the *relation* only, and not the absolute length, which is the object of *precise* inquiry.

The method of Borda, has recently been altered by Biot, who uses a pendulum of less length; the apparatus may thus be more securely and conveniently carried from place to place, enclosed in a glass case. In spite of this improvement, the method of Kater is well entitled to the preference; the first experiment requires no greater care or precautions, and will occupy less time than every separate determination by the method of Borda, and in every subsequent trial, the British method is very much more speedy, is capable of more accurate and comparable results, and is less dependent either upon external circumstances, or upon the skill of the observer.

Besides the method which we have described, our author made use of two others, as checks upon his experiments; the first was that of an invariable pendulum attached to a clock; the second, arose from the variations in the rate of the astronomical clock in different latitudes: we refer to them only as having fully confirmed the results of his other experiments, for their principle is too well understood to need any illustration.

Captain Sabine, after having recounted his several observations of coincidences of the pendulums; of the rate of the clock with the invariable pendulums; of transits and altitudes of the sun and stars, for the rate of the astronomical clock and chronometers; of meridian altitudes of the heavenly bodies for the latitudes of the places of observation,—all with a fulness of detail, which will enable those who may desire to do so, to trace every step of the process from the original observations to the ultimate conclusions;—proceeds to combine his determinations, for the purpose of calculating the compression of the earth. The mode he employs, using the thirteen stations visited in his voyages, is that given by La Place, in the third book of the *Méchanique Céleste*, founded upon the principle of the least squares.

This calculation gives the fraction $\frac{1}{2885}$ for the compression: a very remarkable result, in consequence of its being the same that expresses

the ratio of the centrifugal, to the gravitating force. Not content with his own measures, he has next combined them with those of Kater, at the stations of the British, and of Biot, Arago, &c. at those of the French survey; and in every combination he is led to the same result. With such a confirmation, we are warranted in saying, that we conceive this value for the compression of the terrestrial spheroid, is more entitled to confidence, than any other that has yet been given; and when we consider its remarkable agreement with the ratio of the central forces, we cannot help believing that there may be some connexion between the external figure of the earth, and its internal constitution, that still remains to be investigated, and which we consider highly deserving the attention of the few mathematicians in the world, who are competent to the investigation.

This determination of an ellipticity of $\frac{1}{288.3}$, differs much from any other, whether derived from former experiments with the pendulum, from the measure of contiguous, or of distant arcs of the meridian.

It is, however, entitled to the highest confidence, inasmuch, as it is the first that has been drawn from observations of the pendulum, unconnected with any other operation. It is very remarkable, that, whilst the pendulum has a right to be considered as a mode of determining the relation between the polar and equatorial axis, perhaps, more certain than any other, it has never, before the present day, formed the principal object of observation; but has always been confided to the same persons, who were employed either in performing geodetic operations, or in calculating their results. We would not charge these distinguished philosophers with unfairness; they are far above any such suspicion; but would merely remark the singular coincidence that has from time to time been found, between the deductions obtained by means of the pendulum, and by the actual measure of arcs, when used to confirm each other. The French commission, who reported the *Système Métrique*, inferred an ellipticity of $\frac{1}{334}$ by comparing the degrees measured in France with that measured in Peru; and this oblateness is employed by them as the foundation of that system, so beautiful in theory. La Place, who was one of that commission, calculated the compression of the earth, from 15 lengths of the pendulum, measured at different places, and inferred that it was $\frac{1}{338}$. This, if accurate, might have fairly been received as a strong confirmation; but on examination of his calculation, as given in the third book of the *Méchanique Céleste*, an error in taking out a logarithm will be detected; and correcting this mistake, the deduced ellipticity, by his method of calculation, would be increased to $\frac{1}{319}$. Since that period, and when the compression deduced from the measure of more distant arcs, became $\frac{1}{308}$; and that which agrees with the inequalities in the lunar motion, arising from the shape of the earth, is supposed to be about $\frac{1}{304}$; the same illustrious author, by admitting the new observations of Biot, and Arago, infers from the general combination of pendulum experiments, an ellipticity of $\frac{1}{310}$. No better proof can be afforded than this, of the facility with which the few observations that had been made, before the pendulum was taken up by Great Britain, as a distinct and independent method, could be

made to agree with any hypothetical oblateness of the terrestrial spheroid, when examined merely for the purpose of confirming or disproving the calculations, whose data are derived from other sources.

It is now time that the pendulum should assume the rank of an independent measure of the relation between the two diameters of the earth; and the credit is due to Captain Sabine, of having been the first experimental philosopher, who has distinctly asserted its equal claim, as well as proved by his experiments, its right to be so considered. His experiments have, in fact, done more than place it on an equality, as present authority, with the measurement of terrestrial degrees: in his hands, it has become the only method of deducing the figure of the earth, which, as yet, has given a precise and determinate result.

We fully concur in Captain Sabine's opinion, that the satisfactory and conclusive nature of the result, which the pendulum has afforded, when the experiments with it, have thus been duly and sufficiently extended, presents a strong ground of encouragement to attempt an equally conclusive result, by the comparison of terrestrial measurements undertaken on the same decisive scale, of which, his experiments with the pendulum, afford the example. He has suggested a proceeding towards the attainment of such a result, which we cannot do better than lay before our readers, adding our persuasion that it is well entitled to the serious consideration of every man of science, who, either in his public or private capacity, may have it in his power to promote its execution.

"The success which has thus attended the attempt to carry into effect, under the conditions most favourable for the experiment, the method of investigating the figure of the earth by means of the pendulum, and the consistent and precise result, far exceeding previous expectation, which, under such circumstances, it has been found to afford, encourage the belief, that an equally satisfactory conclusion, and one highly interesting in the comparison, might be obtained, by the measurement of terrestrial degrees, performed also under the requisite conditions to give its due efficiency to the method of experiment. Experience has fully shewn, that no result of decisive character is to be expected from the repetition or comparison of measurements in the middle latitudes; and that it is only from operations carried on, in portions of the meridian widely separated from each other, that such an event can be regarded as of probable accomplishment. The project of the original experimenters,—of those eminent men, who nearly a century ago, devised and executed corresponding measurements at the equator and at the arctic circle,—was of far more vigorous conception, than the steps of their successors have ventured to follow, even to the present period; and it is due to their memory to recognise, that the failure on that occasion, was not from insufficient extension of view, or from deficiency in the spirit of enterprise; but from the attempt having been made in the infancy of practical science, when the instruments were inferior, and the modes of their most advantageous employment, less understood, than they have since been rendered.

"The discordancies, which appear in the comparison of the mea-

surements hitherto accomplished, are not so great as those which had resulted from the comparison of pendulum experiments, previously to the present attempt to give the latter method, its full and efficient trial: it has been also seen, that in proportion as the arcs have been enlarged, so as to include the continuous measurement of more extended portions of the meridian, and as the processes of operation have been conducted with improved means, and increased attention to accuracy, the anomalies have progressively diminished; the prospect, therefore, that they may be made wholly to disappear, by combining the interposition of the greatest interval between the measurements that the meridian of a hemisphere will admit, would seem sufficiently probable to justify and induce the undertaking.

"Through the munificent liberality, and splendid patronage of the East India Company, India already presents a determination of the arc contained between the 10th and 20th parallels: and as a consequence of the political changes which have recently taken place in South America, there is reason to hope, that the impediments to a measurement between the equator and the 10th degree, in the quarter of the globe, best suited for the operation, will speedily be removed.

"In regarding the polar extremities of the meridian, the attention is naturally directed in the first instance, to Spitzbergen, as the land of highest convenient access in either hemisphere; its qualification, in that respect, is indeed far beyond comparison with other lands, and is a point of very principal importance; its high latitude and conveniency of access, do not, however, form its only suitability; for, on due consideration, it will be found to possess many very peculiar advantages for the operations of a triangulation.

"The general geological character of Spitzbergen, is a group of islands of primitive rock, the ordinary hills of which, are from 1000 to 2000 feet in height, commanding generally extensive views, and unincumbered with the vegetation which presents so great an obstacle to the connexion of stations in the more genial climates. The access to all parts of the interior is greatly facilitated by the extensive fiords and arms of the sea, by which the land is intersected in so remarkable a manner; these, whether frozen over, as in the early part of the season, or open to navigation, as in the later months, form routes of communication suited to the safe conveyance of instruments either in sledges* or in boats; the fiord, in particular, which separates the western and eastern divisions of Spitzbergen, would be of great avail; it extends in a due north and south direction for above 120 miles, with a breadth varying from ten to thirty miles, and communicates at its northern extremity, by a short passage across the land, with the head

* Sledges with reindeer trained to draft, and the Fins by whom they are managed, may be hired for the season, at Hammerfest, in any number that might be required. Spitzbergen abounds more in the food of the reindeer, and is more plentifully stocked with the animals themselves in their wild state, than any other arctic country which I have visited. The officers of the Griper killed more than fifty deer on the small islands which form the northern part of the harbour of Fairhaven.

of another fiord, proceeding to meet it from the northern shores of the island; and affording similar facilities for carrying on either a triangulation or a direct measurement, on the surface of the ice, at the level of the ocean. It is hardly necessary to add, that the latter operation would be unembarrassed by the inequalities of surface, and uncertain temperature of the apparatus, which occasion so much trouble, and require so much precaution in the usual determination of a base.

"The extent of the arc in the direction of the meridian, between the southern shores of Spitzbergen and the islands on its northern coast, in the eighty-first degree of latitude, is between four and five degrees. At the period of the celebrity of Spitzbergen as a fishing station, in the middle of the seventeenth century, when above 200 vessels, manned by 10 or 12,000 seamen, annually resorted to its vicinity, and frequented its harbours for the purposes of boiling oil, and when the harbours were divided by convention, amongst the vessels, in consequence of their numbers, according to the nation and towns to which they belonged, all parts of the coast were known to, and visited by the hardy and enterprising Dutch and German seamen, by whom the fishery was then principally conducted. The whales have long since deserted the haunts which their kind had enjoyed for ages before in unmolested security, and have sought retreats less accessible to man; the graves, which occupy every level spot around the harbours, contain the only, and, in that climate, the almost imperishable memorials of the once busy scene, which has reverted to its original solitude; even the accidental presence of a whaling ship, in the western harbours, is an event of rare occurrence,* and it is probable that more than half a century has elapsed, since any vessel has passed to the north-eastern shores; it is not surprising, therefore, that the delineation of land, represented in the charts of the period when Spitzbergen was so greatly frequented as existing to the east of the seven Islands, and to extend in a northerly direction far into the eighty-second parallel, should neither have been established nor disproved by modern authorities; those persons who have had opportunities of becoming acquainted, by examination on the spot, with the remarkable correctness of the older charts in general, in the insertion and in the relative position (when not separated by much extent of ocean) of lands then recently discovered, will hesitate too hastily to reject their testimony, until it has been satisfactorily disproved; should land exist as represented in the charts of the period alluded to, even though not visible from Spitzbergen, its triangular connexion might be established on the surface of the ice, and latitudes yet unattained be included in the operations of the survey; nor would it be safe to assign too con-

* During the Griper's stay of three weeks in the neighbourhood of the harbour, of principal resort in earlier times, and in the middle of fishing season, not a single whale fish, or whaling ship was seen. The only vessels which now frequent the shores of Spitzbergen, are Norwegian sloops in quest of Sea Horses, and eider down. Their visits have been hitherto confined to the fiords and the islands on the southern and western coasts; they arrive early in March, and remain as late as November, making occasionally three voyages in a season.

fidently the northern limit of such operations, even in the absence of land, in our present ignorance of the facilities which the ice itself may afford, for their extension towards the pole.

"The measurement of a portion of the meridian, in the higher latitudes, is, however, one of the many experimental inquiries, beyond the reach of individual means to accomplish, for which the advancement of natural knowledge is delayed; if its accomplishment may be hoped for by that nation, which has been most forward in exploring the regions of the north—to whom its climates, and its natural difficulties are familiar—it must still await the existence of a channel in one of the departments of the state, through which the liberal disposition of the British government to forward every undertaking worthy of a great nation, and by which it may occupy an additional page in history, shall be rendered available to other branches of scientific research, than those which are immediately conducive to the interests of navigation."—p. 360—364.

There can be no question that the measurement of an arc of the meridian of Spitzbergen, of sufficient magnitude, to render inconsequential the irregularities in the direction of gravitation at its extremities, (and such would be an arc of $4\frac{1}{2}$ or 5 degrees,) would be one of the most important, as well as one of the most splendid, of those enterprises, for the advancement of general knowledge, which, from time to time, have received the support of enlightened governments, and have commanded the admiration of all civilized nations. To those persons, to whom the climates of the north, and the difficulties presented by its icy seas, and barren shores, are not as familiar as they are to our author, the natural impediments to the accomplishment of such an undertaking, may appear in a more serious light, than they are viewed by him, who has had experience of the means by which they may be surmounted, and has himself proved, that such extreme situations, are not incompatible with the utmost accuracy of experiment. But we do not hesitate to say, that the attempt, even if it should terminate in demonstrating the impracticability of accomplishment,* would do honour to the government, and the country, by which it should be made; and, that there is no country so competent to the undertaking, as Great Britain; nor any time so suitable as the present; when the experience which she has gained in her northern voyages, (which have long since ceased to have any more important practical object in view, than the acquisition of such experience, and the cultivation generally of a spirit of enterprise,) may be most advantageously applied in the attainment of a purpose, of the highest rank in the advancement of science; and in the general interest of which, the nations of every quarter of the globe, and of all succeeding periods, will participate. It is time that Great Bri-

* We are happy to have it in our power to state, that the proposed measurement of an arc at Spitzbergen, was brought under the notice of the President and Council of the Royal Society, previously to the last recess; and that the propriety of recommending to the government an undertaking so important to the advancement of natural knowledge, is now under consideration.—*Editor, Quarterly Journal.*

tain, pre-eminent as she is in commercial enterprise, and in that of maritime and geographical discovery, with wealth at command, and a government well disposed to "forward every undertaking worthy of a great nation, and by which it may occupy an additional page in history," should assert a like pre-eminence, (which she does not, at present, possess,) in enterprises of a higher character, than the mere tracing the direction of a river, or the completion of the outline of distant, and, for any useful purpose, unprofitable shores.

We proceed to notice, and we shall do so as briefly as possible, the bearing of Captain Sabine's experiments upon the application of the pendulum, as a standard of measure, and upon the experiments which are previously considered to have referred the British linear scale, to a definite length in nature. It is in this relation, that we consider his work as entitled to the greatest attention; because the pendulum furnishes, in all probability, the only natural standard of measure, that is invariable, determinate, and easily determinable; and as such, it has become the subject of legislative enactments, having been adopted in an act passed in the session of 1824, and referred to as the means of identifying the authentic, legal scale of Great Britain: there can be no doubt, however, after the perusal of Captain Sabine's remarks, in pages 364 to 372, that the provision made by the act, is inadequate for the purpose; and there cannot be a stronger evidence of the importance of more consideration being devoted to the subject, than that the provision of an act, designed expressly for the most distant posterity, should thus be shown to be incompetent to its purpose, even before the act itself has arrived in operation. The act declares the British imperial yard, to bear a certain proportion to the "pendulum vibrating seconds of mean time in the latitude of London, in a vacuum, at the level of the sea." It necessarily assumes, consequently, 1st, that the length in nature so referred to, is of a uniform magnitude; and 2d, not only that it has been measured, but that all future measurements must conduct to an identical result.

With respect to the first point, the experiments that are contained in the present volume, show, conclusively, that the latitude of the place, and its elevation above the mean level of the sea, are not the only, nor even the chief circumstances, that affect the length of the pendulum; and, consequently, that the measurement, in any one place, even supposing it to be correctly made, and reduced to the level of the sea, by an amount which should not be arbitrarily assumed, does not determine the *pendulum of the latitude*, because the nature, and density of the substances that compose the upper crust of the earth, at the place of observation, have a most important bearing, and which cannot be neglected. The clock, and the experimental pendulum, were found to be liable to variations, of not less than ten seconds per day, in the same latitude; according to the nature of the materials upon which they rested; and, as all the observations were necessarily made upon the land, it is inferred, that an equal variation in an opposite direction, might be considered as likely to occur, if the experiments could be performed at different points, on the surface of the ocean: the whole difference, then, that might arise from the

action of the different substances that are found on the surface of the globe, may, in the same latitude, amount to no less than twenty seconds; and the difference in the length of the pendulum, at stations differing in local circumstances, but still under the same parallel, might be equal to 0.01 of an inch; or nearly one-tenth of the whole difference of the intensities of gravity at the pole, and the equator, or to $\frac{1}{2000}$th part of the absolute attraction of the earth. It would thus appear, that before the mean force of gravity, in any parallel of latitude, can be inferred with certainty, numerous observations, indeed an almost indefinite number, ought to be made, in or near that parallel, to produce, by their combination, a near result.

With respect also to the allowance to be applied to the length of a pendulum, measured at a height above the sea, to reduce it to what it would have been, if measured at the level, it is shown that the correction which has been recently proposed, for the error arising from the *figure* of the surface, by which the regular decrease of gravity, in proportion to the squares of the distances from the centre is affected, may be safely neglected; but that a far greater uncertainty than from external conformation, and for which it would be far more difficult to assign a specific correction, is involved by the variable density of the materials, on which the pendulum is raised above the surface of the sea. From these considerations, Captain Sabine concludes that the pendulum of a particular *latitude*, cannot become a standard of reference, because its length is not practically determinable; that the pendulum of a particular *city*, London for example, (whereby it is implied that a length measured in one part of the city, should be recoverable by a measurement made in some other part of the city,) is open to the same objections, though in a less degree; but that the more simple standard, and which is of determinate, and determinable magnitude, is the pendulum of a particular *spot;* it being understood that all future repetitions, designed to produce identical results, should be made identically at the same place.

We consider, that Captain Sabine has gone far towards proving, that, in this view, the pendulum is applicable to the proposed object; that, with proper precautions, and by adopting the method of experimenting, which he has pointed out, different observers, using different instruments, may arrive, with certainty, at identical conclusions: at least so nearly identical, as not to differ in the fourth place of decimals of a British inch.

But he has also shown, (pages 213 to 233,) that the method which was previously adopted, and employed in the experiments which are considered by the act of parliament to have determined the length of the seconds' pendulum in the latitude of London, does by no means insure identity on repetition within the limits declared in the act; because the method is not independent of individual peculiarity, or of accidental circumstance. The conviction is thus forced upon us, of how essential the experiment itself of repetition, is; and that it is expedient to prove, that a method will produce identical results, in other hands than the original experimenter, before it is officially bequeathed, for such purpose, to posterity.

The selection of a spot, the pendulum of which is to supply an invariable length in perpetuity, and which will require to be referred to, not less by foreign nations of the present day, who may desire to compare their standards with that of Great Britain, than by those of more distant ages, who may seek the recovery of the British measures, is by no means an indifferent consideration. It has happened, accidentally, that the original experiments were made in a private house in London: a circumstance which, in itself, must, sooner or later, have obliged their repetition elsewhere. But, if the length of the pendulum is affected by natural local circumstances, to the amount we have stated, (and we think the fact too clearly made out by Captain Sabine, to be questioned,) may not even artificial changes in the character of the place of experiment, produce a similar result, although in a less degree? Can we be assured that the vibrations of a pendulum, in Mr. Browne's house, in Portland place, are the same now, as when, not more than two centuries ago, its site was nearly a mile without the limits of the city? Nor are either of these times identical with that which would be found, were the future observer compelled to seek for the spot amongst masses of rubbish. Nor is this last view of the subject, however improbable or distant, one that is to be entirely neglected. The language, the arts, and the sciences, which are the boast of Great Britain at the present day, are founded upon a basis more secure than that of empire, and will exercise an intellectual supremacy over future ages, should even the fate that has attended the former "glories of the world," overwhelm, at some remote period, her proud metropolis. It must ever be remembered, that on the transmission of her scale, will depend the value to posterity, of every attainment which she either has made, or may make, in which linear measure is concerned; and that, consequently, her fame and her usefulness, in those distant times, may be materially influenced by the provision which she may now make, for its exact transmission.

For these, and for other reasons, which we have not space to state, we should consider it highly expedient, that, whenever Kater's original experiments shall be repeated, for the final verification of the British scale, the proceedings should take place in a public building, and at such a distance from any probable extension of dense population, as may secure a close resemblance to its present state, for centuries; and that, when the pendulum of that spot shall be considered as fully, and satisfactorily determined, other nations, which may be disposed to adopt a similar proceeding, should be invited to a direct comparison of the standards and measurements of the respective countries; not only for the more perfect assurance of accuracy, but in order that the places may be multiplied, on the globe, at which the British measures may be, hereafter, reproducible.

We perceive that we have already attained our limits, in the examination of the subjects contained in little more than half the work before us: the remainder consists of geographical, hydrographical, and magnetic notices of great interest, particularly the latter. The subjects, however, are distinct, and require, in fact, to be treated of, separately; we shall not, therefore, however worthy they may be of

notice, trespass further on the patience of our readers; but shall conclude with recommending its perusal to all persons who take an interest in such investigations, as one of the ablest works with which we are acquainted.

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—No. 4.

BY P. A. BROWNE, ESQ.

On Mechanics' Liens.

The next point for consideration, as relates to the subject matter of the contract, is,

3. The contract of exchange of labour or materials.

It sometimes happens that mechanics and material men, instead of contracting, in the usual way, for money, stipulate with each other to exchange labour for labour, or materials for materials, or labour for materials. Whether persons thus situated, have a right to file claims against the buildings, has been made a question. The judges of the district court, M'Kean and Ingersoll, were divided in opinion, and the cause was removed to the supreme court, where it has been determined, that the lien is extended to such contracts. S. C. Dec. 1825. Hinchman *v.* Lybrant.

The time within which the contract is to be executed.

The materials may be furnished, either *before* the commencement of the building, or while it is progressing; but if they are furnished *after* the building is finished, no lien is created.

It is no uncommon thing to collect the materials for a building, and prepare the sashes, doors, &c. before the building is commenced; and when this is done in the regular course of business, there would be no equity in excluding them from a lien; but every man is required, to exercise *common care* and *prudence*, in the management of his concerns; and common care and prudence are wanting, where materials are furnished, *after* a building is finished.

Therefore, in the case of the Olympic Theatre, the court admitted as liens, all materials furnished *before* the building commenced, and *while it was progressing*, but they refused to admit any claims, for materials furnished, *after the building was finished.*

The place over which the contract operates.

The law of 1803 was confined to the city of Philadelphia, the district of Southwark, and the township of the Northern Liberties. The act of 1806 speaks of the city and county of Philadelphia; and by several subsequent acts, the benefit has been extended almost over the state.

The second general question is, "Upon *what* does the lien attach?"

The words of the act are, "all and every dwelling house, or other

building;" which expressions, as we have before seen, includes every edifice whatever.

We shall now proceed to inquire, what things are included under the above expressions.

These are: 1. The *lot*.—2. The *appurtenances*.—3. *Fixtures*.

1st. The *lot*.—Although the act of assembly speaks of the lien as attaching to the building only, yet the lot on which it stands, and as much as is required for its necessary enjoyment, is also affected by the lien, and may be sold with the building. It is evident, that the legislature intended to grant to the lien creditors, the *full* benefit of the building, as a fund to pay their debts, and this would not be done by giving the house, and not the lot.

The first case in which this question was made, was Browne *v.* Smith, 2 Browne's Rep. 229, in note. The case was this: The defendant was seized of a lot in the city of Philadelphia, upon which he erected a building, in doing which he contracted debts to material men. After the commencement of the building, the plaintiff recovered a judgment against him, and issued executions, upon which both house and lot were sold. It was contended on behalf of the judgment creditor, that the lien creditors, were entitled to be paid out of so much of the purchase money, only, as represented the building, leaving the proceeds of the lot, to pay the judgment; but Rush, president, delivered the opinion of the court, that the house and lot were both equally subject to the claims of the lien creditors.

The same point came before the district court, for the city and county of Philadelphia, in the case of the Olympic Theatre, but the court expressed no opinion thereon.

The case of Lyle *v.* Ducomb, 5 Binney's Rep. 585, was a decision, by which the mortgagee of a lot of ground, took not only the ground, but the buildings erected subsequently to the mortgage, in preference to the lien creditors, and that decision was founded, in part, upon the reasoning that supports the case of Browne *v.* Smith; and, so far, corroborates Judge Rush's opinion.

2ndly. The *appurtenances* to the building and lot.—There are many things which are usually used with a house, or other building, and which are so inseparably connected with them, that the enjoyment is not perfect without them, these, in law, are called *appurtenances*. The word is derived from the French word "*appartenir*," to belong to. As it would be extremely inconvenient, and sometimes impossible, to enumerate these, on all occasions, it is a rule of law, that they pass by the grant of the principal. In like manner, they are bound where the principal is bound.

The case of M'Ilhenny *v.* Pratt, before cited, furnishes a very correct instance of the appurtenances being bound; so much so, that we need seek for no other exemplification. A court was laid open, upon each side of which certain houses were erected: now every one will perceive, that if the court was closed, the tenants would have no means of passing to and from their dwellings, and, consequently, the enjoyment of the buildings would be nearly, if not entirely destroyed. The court, then, was a necessary appendage to the house, it was an

appurtenance, or belonging to it, and, as such, was bound by the lien.

3dly. The *fixtures*.

With respect to what are termed in law, *fixtures*, I would observe, that they are of two kinds; those that are accessary to things of a *personal* nature, as to the carrying on of trade, in which case they are considered as *chattels;* and those that are necessary, as accessaries to the enjoyment of the inheritance, when they are considered as a part thereof. It is the latter class only that are bound by the mechanic's lien. The law on this subject, was reviewed in the case of the Olympic Theatre.

The third general question is, what is the nature of the *preference* given?

This may be divided into the following heads: As regards a *previous mortgage*.—As regards a *subsequent* mortgage.—Where there are *two funds*.—As regards a *previous judgment*.—As regards a *subsequent* judgment.—As regards the lien of a vender of the lot.—As regards a rent charge.

As regards a *previous mortgage*.—The act declares that the building shall be subject to the debts of the mechanics and material men, "before any other lien, which originated subsequent (subsequently) to the *commencement* of the building."

Rule 1. The mortgagee of a lot of ground, upon which a building is *afterwards* erected, is preferred, both as to the lot and the building, before the mechanics and material men, whose debts were created in erecting the building.

In the case of Lyle *v.* Ducomb, 5 Bin. Rep. 585, the plaintiff had a mortgage on a lot of ground, the property of the defendant, on which was a *frame* building. Subsequently to the date, and the recording of the mortgage, the defendant pulled down the frame building, and erected a brick one in its place; and the supreme court were of opinion, that the mortgagee had a lien, not only on the lot, but on the *building erected subsequently to the mortgage*, in preference to the workmen and material men.

Rule 2. And if, instead of the mortgage being given for *a debt actually due*, it be given to indemnify the mortgagee against loss in consequence of his drawing notes in favour of the mortgager, yet the mortgagee has a lien on the lot, and the buildings erected subsequently to the date and recording of the mortgage.

Rule 3. In like manner, if the parties, by indorsement on the mortgage agree, that instead of *drawing* notes for the whole amount, the mortgagee shall *indorse* part, for which the mortgage shall be a security, the mortgagee will have a lien for the indorsements, not only against the mortgager, but also against the mechanics and material men, who subsequently erect a building on the lot.

These positions are all supported by the decision in Lyle *v.* Ducomb, in 5 Bin. Rep. 585.

Rule 4. But if a mortgage is given upon a lot, upon which a building is afterwards erected, at the commencement of which building, the six months, allowed for recording a mortgage, had not expired, and

after the expiration of the six months, but before the filing of the claims of the mechanics and material men, the mortgage is recorded, and the property is sold within two years from the commencement of the building, the lien creditors will be preferred to the mortgage.

The ground of this decision is, that the mortgagee has been guilty of latches, in not recording his mortgage within the period prescribed by law; whereas the lien creditors have complied with the conditions of the act of assembly; and the maxim of law is "*vigilantibus non dormientibus, servit lex.*" The law regards those who *watch*, and not those who *sleep*. It protects those who take due care of their property, and allows the neglectful to suffer from their own want of attention.

The case, in which the point came before the court, was Mitchell *v.* Evans, 2 Browne's Rep. 329.

ENGLISH PATENTS.

Specification of the Patent granted to JOHN FUSSELL, *Edge-tool-maker, for an improved method of heating woollen cloth, for the purpose of giving it a lustre in dressing.*

To all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said John Fussell, do hereby declare that the nature of my said invention of an improved method of heating woollen cloth, for the purpose of giving it a lustre in dressing, and the manner in which the same is to be performed, is fully described and ascertained as follows, that is to say:—My invention consists in an improved method of applying steam to the heating of woollen cloth: (that is to say)—After the cloth is perfectly dressed, either by gig machine, or by hand dressing, I roll it upon a hollow roller or rollers, so contrived as to receive, or enclose the list or forrel, by which process, the stains or wrinkles, which are usually produced by rolling the cloth upon the solid roller or rollers in common use, are avoided. I then place the cloth on end, for the purpose of shifting as much of the water, as is usually shifted previously to racking. In the next place I submit the cloth to the action of steam for about three hours, more or less, according to circumstances, either by suspending it over water, in a common furnace, or by placing it in any apparatus contrived for the purpose, and capable of receiving one or more rolls of cloth at a time, or by any other convenient and suitable means, in which steam is, or may be, raised in the usual ways, or conveyed into it from a detached or separate generator, and applied to the cloth; or, if desirable, the steam may be introduced into the roller or rollers, care being taken to prevent the cloth from being stained, by the condensed steam from the forrel. The proper temperature of the steam to be applied to the cloth, may be stated at considerably below the boiling point; but the exact temperature must be regulated by the

judgment of the operator, according to the lustre required, and in some measure also to the capability of the colour to withstand a high moist temperature. When it is desirable to give to the cloth a very high lustre, it may be obtained by shifting less of the water than is usually shifted, previously to racking, and raising the steam to a greater degree of heat, than required to produce a less degree of lustre. In this case, however, the roller on which the cloth is wound, should be made to revolve slowly, during the process of steaming, by mechanical, or other means.

In witness whereof, &c.

Specification of the Patent granted to MATTHIAS ARCHIBALD ROBINSON, *for improvements in the mode of preparing the vegetable matter, commonly called pearl barley, and grits, or groats, made from the corn of barley, and oats, by which material, when so prepared, a superior mucilaginous beverage, may be produced in a few minutes.*

To all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said Matthias Archibald Robinson, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof: (that is to say)—My invention of certain improvements in the modes of preparing the vegetable matters, commonly called pearl barley, and grits or groats, consists of a peculiar mode of drying, and otherwise treating the grain, by which process, its vegetative properties are destroyed, and a meal is produced, divested of rawness, and free from the impurities of husk or fibre; which meal, when so prepared, is soluble in water, and will make a fine mucilage, in a few minutes. Any quantity of pearl barley, or groats, intended to be operated upon, is taken in the state it is usually sold, and the first process in preparing is to cleanse it, by winnowing, from seeds, husks, dirt, dust, and other impurities. After this the grain is carefully looked over, and any extraneous matters, which have not been separated by the winnowing, are then picked out. In this cleansed state, the grain is put into sieves, and spread over their bottoms in level layers, about three quarters of an inch thick. The sieves are then deposited on ledges, in closets heated by steam-boxes, or steam-passages, the temperature of which should be gradually increased to 160° or 170° of Fahrenheit's thermometer. Under this temperature the grain must be suffered to remain, drying gradually, for about four hours, the aqueous parts evaporated, being drawn off by suitable pipes, leading from the hot closets. By these means, the vegetative properties of the grain will be destroyed, and the raw taste removed, without parching or roasting it. When the grain has been thus sufficiently dried, it is spread out in hoppers, or troughs, to cool, and when that is effected, it is to be passed through funnels, to the hoppers, down to steel mills, (if ground by stone, they are liable to gritty substances;) where it is

ground by steam, or any other efficient power; sliders must be introduced into the funnels, for the purpose of regulating the supply. The meal, falling from the steel mills, is received into boxes or receivers, and is thence removed, for dressing, into bolting machinery of the ordinary construction. The cylinders of the bolting machines should be made of fine wire gauze, from twenty-four, to forty-eight, in the inch, and when the meal has passed through the finest of these, it may be considered to be completely fit for use. A table-spoonful of the prepared barley-meal, may be mixed up in two spoonsful of cold water, and when perfectly smooth, one quart of boiling water is to be poured upon it. This being suffered to boil for ten minutes, will produce the mucilage called barley water, which should be then strained through muslin, if required, flavoured with lemon peel or juice, and sweetened with honey, refined sugar, or sugar candy. An excellent food for infants may be made, by mixing the above proportion with milk and water, instead of water alone. It will also be found to be a very desirable material for thickening broths; it may be mixed and introduced into the broth, half an hour before it is taken off the fire. Puddings, of an excellent quality, may also be made from the prepared barley meal; the powder of the prepared groats is to be mixed in the same way, and a gruel may be produced in ten minutes, of a quality very much superior to any other gruel, made from any preparation of grits or oatmeal, heretofore introduced to the public. I am aware, that several variations may be made in the process above described; but I wish it to be understood that I rest my claim of patent right, in a method or methods of drying the grain under a regular temperature, without roasting or parching it, so as to destroy its vegetative properties, and at the same time retain its nutritive qualities unimpaired, and of clearing it from its fibrous and husky parts, after grinding, leaving only the pure and fine meal; by which preparation, the meal is brought into a condition, that will enable it to keep perfectly good, in any climate.

In witness whereof, &c.

To John Ham, *of West Coke, in the County of Somerset, Vinegar Maker, for his new invented, improved process, for manufacturing Vinegar.*

The object of the patentee, is to expose the liquor of which the vinegar is to be made, as much as possible, to the action of the atmosphere; and, for this purpose, he proposes to employ an apparatus that shall not only constantly keep the liquor in agitation, but shall also run it over extended surfaces, and cause it to be separated into drops, that the air may act upon the liquor in its most divided state, and thereby increase the acidity, and promote its rapid conversion into vinegar.

There are no drawings accompanying the specification; but it is proposed to make an aperture in the lid of the vat or other vessel, containing the liquor previously fermented, and to insert a pump

through this aperture, extending to the bottom of the vat, and rising a little above the lid. This pump may be worked by any suitable mechanical power, and which is not only to produce the alternating strokes of the piston, but also to cause the pump to be turned round horizontally.

The upper part of the vat, containing the liquor, is to be occupied with small twigs or bushes, piled upon bearings, placed across in the middle; and near the top of the pump, immediately under the lid of the vat, two or more spouts are inserted, for the discharge of the liquor raised by the pump; and also in the sides of the vat, near its top, there are to be perforations for admitting the air to the interior.

The apparatus being thus prepared, and the liquor to be operated upon occupying the lower part of the vat, the pump is now put in action, when a quantity of liquor raised at every stroke of the piston, will be thrown over the surfaces of the bushes, and these dripping from twig to twig, will, in that divided state, be submitted to the action of the air within the vat, and as the pump continues to revolve, every stroke will throw the liquor on to a different part, and by that means, keep the liquor constantly flowing over the whole surface of the bushes, and descending, by drops, to the bottom.

In this way, by continually pumping, it is intended that the air shall act upon the liquor, and in the course of about fifteen or twenty days the vinegar will be completely made. The acidification of the liquor may, however, be still further promoted, by causing a rapid circulation of the air within the vat, and this is proposed to be effected by employing a blowing machine to force air through the apertures, near the top of the vat, or by employing an exhausting air pump, which shall draw the air from the vat, when fresh air will force its way into the vat, and thereby produce a constant current.

This process may be carried into effect by apparatus constructed in a great variety of ways; it is not, therefore, the intention of the patentee, to confine himself to any particular forms, or dimensions, as he considers that he is entitled to the exclusive exercise of this principle of operating, in every way that it may be carried into effect.

To MOSES POOLE, *of the Patent Office, Lincoln's Inn, in the County of Middlesex, Gentleman, in consequence of a Communication made to him by a certain Foreigner, residing abroad, for the Preparation of certain Substances for making Candles, including a Wick peculiarly constructed for that purpose.*

This invention is a mode or modes of extracting from tallow a peculiar substance, resembling spermaceti both in quality and appearance, which is designed for the manufacture of candles. The patentee states the invention to be "a mode or modes of clarifying tallow, or any kind of animal fat; and in order to effect this, it is necessary, first, to convert the component parts of the tallow, or fat, into acids, and afterwards to separate one acid, which is in a liquid state, from the other, which is solid."

It may be here desirable, for the sake of information, to mention (though it is not stated by the patentee) that animal fat is chiefly composed of two substances, chemically denominated *stearine* and *elaine;* these substances, when saponified by the admixture of an alkali, produce—stearine, *margaric acid*—elaine, *oleic acid;* the margaric acid being solid and crystalline, the oleic fluid and oily.

The specification proceeds to state, that the liquid acid is fit for most of the purposes to which oil is usually applied, and the solid acid is the substance intended to be made into candles.

There are several processes by which the two acids may be obtained, one by the saponification of the tallow or fat, and another by its distillation. The saponification may be effected by incorporating soda, potash, lime, or any other of the alkalies with the fat, as is commonly done in making soap, and the soap thus obtained, is to be decomposed by a suitable acid, according to the base of the alkali employed. This decomposition should be made in a large quantity of water, kept well stirred during the operation, and warmed by steam introduced in any convenient way. When the mixture has been allowed to stand, the acid of the tallow, or fat, will rise to the surface, and the water being drawn off, will carry the alkaline or saline matters with it; but if the acids of the tallow should retain any portion of the salts, fresh water may be thrown upon it, and the whole well agitated, until the acids have become perfectly free from the alkaline matters; and when allowed to cool, the acids will be formed into a solid mass. This mass is now to be submitted to considerable pressure, in an apparatus such as is employed in expressing oil from seed, when the liquid acid will run off, in the form of a substance resembling oil, leaving a solid matter, similar in every respect, to spermaceti, which is fit for making candles.

The distilling process is effected by submitting the tallow, or fat, to heat, in any ordinary alembic, or distilling apparatus. To facilitate the evaporation, a small quantity of steam may be introduced, which will be condensed over with the other products, in the worm, or other cold receiver, that may be used. The operation may be prolonged, by keeping up a continual supply of tallow; but in this case, the products distilled over must be watched, as they become coloured by this process, and require to be separated, according to their different qualities.

The substances produced by this distillation are, the two acids above described, which, in order to be purified, are to be washed with warm water, as in the preceding operation. The liquid and the solid acids are then separated by pressure, as before described, and if exposed to the air and sun, or treated with alcohol, as is usually practised in the bleaching of wax, the material will be improved in colour.

The above described operations may be combined, for the purpose of obtaining the acids more pure, and free from saline matters; that is to say, after having obtained them by saponification, they may be distilled, and afterwards separated by pressure, as before said.

The patentee says, he does not claim the distinct processes of sa-

ponification, or distillation, but only when combined with the pressing, for the purpose of separating the liquid from the solid acids, after employing either or both of the processes in question.

The wick to be used in the manufacture of these improved candles, and which forms one of the features of this invention, is to be made of cotton yarn, twisted rather hard, and laid in the same manner as wire is sometimes coiled round the base strings of musical instruments. For this purpose, straight rods or wires are to be procured, of suitable lengths, and diameters, according to the intended size of the candles about to be made, and these wires having been covered with cotton, coiled round them as described, are to be inserted in the candle moulds, as the common wicks are, and when the candle is made, and perfectly hard, the wire is to be withdrawn, leaving a hollow cylindrical aperture, entirely through the middle of the candle.

The subject of this patent is the invention of the celebrated French chemist, M. Gay Lussac, and is taken out in this country by Mr. Poole, merely as an agent. The discovery appears to be the result of profound chemical knowledge, and not the effect of mere accident, which frequently happens; the advantages, however, of the invention, as applied to the making of candles, must depend upon the comparative costs of this new material, and spermaceti, for which it is proposed as a substitute, and to be rendered at a lower price.

[*London Journal.*

PATENT LAWS OF DIFFERENT COUNTRIES.

It is believed that the subject of *Mechanics' Liens*, will be completed, in one more number of the essays on "Mechanical Jurisprudence." Those which will immediately follow, will contain a complete view of the patent laws, of Great Britain, and of the United States; both as regards their enactments and operation. The following information, respecting the patent laws of France, Prussia, Austria, the Netherlands, and Spain, will, undoubtedly, be acceptable to many of our readers.

FRANCE.—*By a Decree of the National Assembly.*

Every discovery, or invention, is the property of the inventor, and is secured to him by the law.

Every addition, which is an improvement to an invention, shall entitle its discoverer, to the same privileges as the original inventor.

Whoever shall first introduce into France, a foreign discovery, shall enjoy all the same advantages as if he had been its author.

Persons applying for patents, must state in writing, whether the object he presents is his invention, his improvement, or an importation. He must deposit, under seal, a full account of the principles, and process of the discovery, with plans, designs, or models, to illustrate it.

Patents are granted for FIVE, TEN, or FIFTEEN YEARS, at the choice of the applicant. For a longer term, a special law must be obtained.

Specifications of patents actually in use, are open to the examination of every citizen, excepting when, for special reasons, the legislative body, has allowed an invention or discovery to be kept secret.

Those who infringe patents, are liable to a suit for damages, and whatever infringes the patent, may be seized. For a first infringement, the penalty cannot exceed 3000 livres; for a second, this sum may be doubled.

A patentee may dispose of his patent, like any other property. At the expiration of the term, the description is to be made public.

A patentee forfeits his rights, if, in his description, he conceals the true process, or any part of it; if he be convicted of making use of secret means, not detailed; or shall use any which he does not afterwards add to his description. Patents are void, if taken out for a discovery which has already been described, in a work printed and published; if not made use of for two years after the date at which it was obtained; if the inventor obtain, afterwards, a patent for the same thing, in any other country: should *another person* obtain such patent, the rights of the inventor are not forfeited.

Persons purchasing the rights of a patentee, enjoy the same rights, and are subjected to the same penalties, as the inventor.

The government charges for a patent, are:

For a term of FIVE years, - - - - - - - - -	300 livres.
TEN, - - - - - - - - - -	800
FIFTEEN, - - - - - - - - -	1500
For improvements, subsequently introduced into an existing patent, - - - - - - - - - -	24
For legislative prolongation of the term, - - -	600
For enrolment of the specification, - - - - -	12

Besides these, there are some other small charges, for fees to officers, &c.

PRUSSIA.—*Enacted November 14th*, 1815.

Every Prussian subject is entitled to a grant of a patent, for an invention, an improvement, or an importation. Accompanying the application, there must be drawings, and a specification, explaining the objects and detail of the invention.

The privileges are granted, from six months, to fifteen years, and may be obtained for one or more provinces, or for the whole kingdom.

The patentee is bound to publish in the local gazette, within six weeks, the grant of the patent; the neglect of which formality, invalidates the privilege.

In order to encourage industry, *no tax, or duty*, is levied on patents, excepting stamps, and enrolling official charges.

Whosoever proves, that he made use of the invention, or manufacture patented, previous to the date of the grant, is entitled to continue his own manufacture.

The infringements of patent rights, are prosecuted before the pro-

vincial courts of justice, wherein the offending party resides; and the appeal may, from thence, be carried before the Minister of Finance and Commerce.

The first infringement is punished with the costs of suit, and the interdiction of manufacturing the patented article. On further infringements, the seizure of the tools, and manufactures, are ordered, and the patentee may sue for damages.

A patent becomes invalidated and void,

1. If the manufacture has previously been described, and published, in print.

2. If the patentee has not executed his privilege within a given time.

3. If the patentee has himself obtained, for the same, a patent abroad.

4. If the patented article, or manufacture, is dangerous to public safety, or contrary to law.

The sums deriving from enrolling charges, &c. are to be employed for the encouragement of industry.

The same act states, that all former laws, or privileges, are from hence revoked.

AUSTRIA.—*Enacted December* 8, 1820.

The application for a patent of invention, improvement, or importation, is to be lodged before the provincial board of Directors of the applicant's residence.

A true and faithful specification, with drawings thereof, is required.

The patent, dates from the day, and the hour, of the deposit of the application.

The provincial Director, has ONLY to verify, if nothing in the manufacture to be patented, be contrary to law, and the public welfare.

Patents are to be granted, on the report of the government's committee of commerce and manufactures, appointed for that purpose.

The patent duty, or taxation, is relative to the duration of the patent claimed, which cannot exceed fifteen years.

5 years' duty is - - - - - - - - 50 C. florins.*
For the 6th year, - - - - - - - - - - 15

For the 7th is 20, and so on, increasing every year, for fifteen years, by the addition of five florins, to the sum last charged.

One half is to be paid at the deposit of the documents, the remainder by yearly instalments, according to the extent of the patent.

In order to promote the patentee's interest, a prolongation may be obtained, before the expiration of the first patent, if it has been taken for less than fifteen years.

Transfers of a patent right must be legally enrolled, at the office of the committee of commerce and manufactures.

* A Conv. florin is about 45 cents.

Infringements may be prosecuted before the common courts of justice; they pronounce the seizure of the counterfeit manufacture—a fine—and damages.

NETHERLANDS.—*Enacted January the 15th*, 1817.

Patents are granted for five, ten, and fifteen years.

The tax or duty to be paid, is from 150 to 750 florins, according to the duration, and the importance, of the invention, or importation.

A five or ten years' patent may be prolonged to fifteen years, if there be sufficient cause shown of the utility of the invention, &c.; but it can never exceed the fifteen years.

Inventions that have been patented abroad, can only be privileged for the time of the original grant.

The patentee may prosecute counterfeiters before the common courts at law, and obtain the seizure of the manufactured article, or machinery, with costs and damages.

The invalidation of a patent arises,

1. From the manufacture being previously known, described, and published.

2. From the patentee not practising, or manufacturing the same.

3. From the patentee himself having subsequently obtained a patent for the same, abroad.

4. From the patented article being dangerous, and contrary to law.

The sums deriving from patents, are to be employed as recompense, and encouragements, to arts and manufactures, &c.

SPAIN.

A law was enacted by the Cortes, October 2nd, 1820, but this enactment has recently been abolished, by the present king of Spain, and no patent law is now existing there; it is, therefore, unnecessary to publish that which has been repealed.

ON IRON AND STEEL. BY THOS. GILL.—No. 4.

On the use of chilled Cast-Iron, for Punches, and other Tools.

It is well known, that in making holes in red-hot iron articles, such for instance as wheel-tire, horse-shoes, &c. the hardened and tempered steel punches become softened, from the effect of the heat; and, changing their shape, must be repaired from time to time.

Mr. Peter Keir, engineer, of St. Pancras, several years since, having occasion to make many nail-holes, in the wheel-tire of artillery carriages, and horse-shoes; and having experienced the above inconvenience in a very great degree, luckily thought of substituting punches made of chilled cast-iron, for those of steel, and which he found fully

to answer the purpose, as they constantly retained their original hardness, notwithstanding they very frequently became red-hot in using.

As, however, chilled cast-iron is not sufficiently tough to bear bending, without breaking, he found it necessary to strengthen his punches, by surrounding and inclosing their stems in cast-iron holes, made of shapes corresponding with the stems, in properly shaped supports, and having their points only standing out a sufficient length for use.

On forming Cutting Tools of Cast-Steel, as hard and tough as possible.

It is well known that the proper hardening heat for cast-steel, is exceedingly difficult to be attained, and that a very little excess of heat is sufficient to deprive it of its most valuable properties; hence, in order to obtain the edges or points of steel instruments, of the greatest degree of strength for important purposes; such, for instance, as the edges of knives for dividing mathematical instruments,—Mr. Stancliffe, an excellent maker of those instruments, and formerly a workman of the late celebrated Mr. Ramsden's, adopted the following most excellent method:

After shaping the tool, and condensing it by hammering, he carefully heated the point, and quenched it: he then, with the edge of a file, made trial, by filing along from the soft and unhardened part, to that part of it, where it became hard; and formed his cutting part, or edge, by grinding and whetting that part to shape. He was thus assured of the quality of his tool being the best that the steel he employed could possibly produce; nor did it require tempering, as usual.

It is to be hoped, that this valuable process, now for the first time published, will be adopted, wherever tools, possessing all the advantages, in point of hardness and strength, which steel can give them, are required.

On hardening Articles made of Steel-Wire, without bending them.

This valuable process was employed by the late Mr. Rehe, of Shoe-lane, a most ingenious mechanic, in the following manner. The articles having previously been carefully heated to the proper degree, instead of cooling them in water, Mr. Rehe threw them upon the flat surface of a fixed block of cast-iron, and instantly rolled them round, by sliding another flat plate of iron over them; and thus, by this revolving motion, he kept them perfectly straight, in the act of being cooled and hardened, between the metal plate, and the block.

On an improved method of softening or annealing Cast-Steel.

It is very singular, that cast-steel should be *softened* by the very same means which are ordinarily employed to *harden* it; and yet such is the fact.

We have constantly seen, that those parts of the stems of drills, which immediately adjoin to the hardened points, are found to twist much more than any other parts; and also, that those parts of chisels, punches, &c. which are next to their hardened edges or points, are

exceedingly liable to bend, unless they have been made much stronger than would otherwise have been requisite. Yet, notwithstanding that these facts were continually presenting themselves to notice, it does not appear that any use has been made of them, by workmen in general.

Some judicious persons, however, have availed themselves of this singular property, and with great advantage; as by it, they are enabled not only to anneal cast-steel, in much less time than by any other method, but also to free it entirely from those hard spots, usually termed *pins*, which occasion so much trouble to workmen, in filing or turning it.

The process consists *in carefully heating the steel, nearly to the hardening point, and instantly quenching or cooling it in water; and the nearer that heat approaches to the hardening point, the softer the steel will become.*

Cast-steel articles ought always to be thus annealed, previously to planishing them, or condensing them by hammer-hardening; and it is wonderful how much they will stretch under the hammer, after being so treated.

On welding Cast-Steel, and Cast-Iron.

We here furnish our readers with extracts from an article, published by us in the "Annals of Philosophy" in March, 1818; but which, we think, ought also to accompany the other articles "On Iron and Steel," contained in this work.

We first noticed the difficulty of welding the higher converted cast-steel to iron; and stated, that the public were indebted to Sir Thomas Frankland, for the first accurate information on the means of performing it: namely, by heating the iron to a welding heat, and the steel as hot as it would safely bear, when, by dexterous management, the union might be effected, without much injury to the steel.

We then stated our surprise, at the information we had recently obtained, from the late scientific Mr. Samuel Varley, of a smith, in the neighbourhood of Chevening, in Kent, being in the frequent habit of welding pieces of cast-steel together, without injury to them; and in this way *could unite two worn out mill-wright's picks, into a new and serviceable one;* and that in order to prove the value of his process, he, Mr. Varley, had broken a bar of superior cast-steel into two parts, and caused the smith to unite them again; and which was done, without injuring the quality of the steel, in the least degree.

We next added, that having mentioned the latter process to many persons of information,—to most of whom it was a new fact,—we learned from that scientific mechanic, Mr. Charles Sylvester, late of Derby, that he had frequently performed it, *and even with greater ease than he could weld iron, as the welding heat of cast-steel is considerably below that of iron;* and that the chief cause of failure in attempting to do it, was, by persons heating it too much, conceiving that it required to be treated like iron, whereby it had been totally destroyed. That it, however, required a different flux from iron, to prevent its oxidation, to which it is extremely liable; and that the welding

sand used for iron, was totally unfit for this purpose. He preferred *finely-powdered glass of borax*, or the greenish-black glass, of which common bottles are made; which consists of sand and alkali only, having no lead in it, as in flint glass; and he thought, that if it were to be fused, with an additional portion of alkali, it would be still better.

We also found, that Mr. George Scott, another ingenious mechanic, had employed the process for three years past; and a few days since, *had thus united four cylindrical rods of cast-steel, each four feet long, and about half an inch in diameter, after being truly turned in the lathe, into one of sixteen feet long, in order to form a triblet for drawing lead pipes upon.*

But, what was yet more singular, in the course of our inquiry, we were informed by Mr. Jonathan Dickson, engineer, of Holland Street, Blackfriars, that *two bars of cast-iron might thus be united*, their ends being previously enclosed in a wrought-iron tube, and heated to a proper degree; the tube serving as a mould, to prevent the fused cast-iron from falling asunder during the operation.

We then mentioned, that in order to promote the success of welding cast-steel, we would recommend the employment of a charcoal fire; and that the pieces, after being formed of a proper shape for uniting, should have the surfaces intended to be joined, filed bright, be coated with borax, and be bound together firmly by bands, hoops, &c. previously to their being put into the fire: or else, that as soon as they were heated sufficiently, to fuse the glass of borax or bottle-glass, they might be coated therewith on their outsides, either by dipping them into those substances powdered, or by sprinkling them over with them; and that no more heat than was absolutely necessary to effect the union, should be employed, and thus the properties of the steel would be as little injured, as possible, by the process.

We concluded, by adding, that it was no unfrequent practice amongst country smiths, *to unite cast-iron to wrought-iron*, in place of using steel, and particularly for the coulters and shares of ploughs, on account of its cheapness; and that for such coarse purposes, it might answer tolerably well.

OF TANNING, LEATHER-DRESSING, DYING, &c.

(Continued from page 146.)

The dressing and the preparing of the skins of lambs, sheep, goats, and other thin hides, though in many particulars, closely resembling the method used with the thick cow and ox-hides, forms, usually, a totally distinct branch of business; and is one in which a good deal of practical skill, and nicety of manipulation, are required, to succeed perfectly. The processes are very various, according to the article required; and this branch of the manufacture, supplies the immense demand of white and dyed leather for gloves; the (so called) mo-

rocco-leather, of different colours and qualities, for coach-linings, book-binding, pocket-books; and thin leather, for an infinite number of smaller purposes. Of these, the *white leather alone* is not *tanned*, but finished by the process of *tawing;* but the *coloured leather* receives always a *tanning*, (generally by sumach,) independently of the other dying materials. The previous preparation of each, or that in which the skin is thoroughly cleansed, and reduced to the state of simple membrane, in which it is called *pelt*, is especially the same, whether for tawing or dying. *It is thus performed, at the best manufactories, at Bermondsey*, near London, a place long celebrated for all branches of the leather business.

By far the greater number of the skins are imported:—of *lambs*, they are thus prepared: the skins are first soaked for a time in water, to cleanse them from any loose dirt and blood, and put upon the beam commonly used for the purpose, (which is a half-cylinder of wood, covered with strong leather,) and scraped on the flesh side with the semi-circular blunt knife with two handles, used for this operation. They are then hung up, in considerable numbers, in a small close room, heated by flues, where they remain to putrefy for a given time, as is easily perceived by the strong ammoniacal odour which issues from them when the door is opened. During this process, a thick filmy slime works up to the surface of the skin, by which the regularity of the process is judged of, and the wool is loosened, so that it readily comes off with a slight pull. Each skin is then returned to the beam, the wool taken off and preserved, and all the slime worked off with the knife, and the rough edges pared away. The skin is then put into a pit filled with lime-water, and kept there from two to six weeks, more or less, according to the nature of the skin, which has the effect of checking the further putrefaction, and produces a very remarkable hardening, and thickening, of its substance, and probably, also, it detaches a further portion of the slime. The skin is again well worked upon the beam, and much of its substance pared down, and all inequalities smoothed with the knife. Much pains and judgment are required in these operations; on the one hand, not to endanger the substance of the skin by the putrefaction, (which, if carried on too long, would soon reduce it to an incohesive pulp,) and on the other hand, to work out every particle of the slime, the least of which, if retained, will prevent the skin from dressing well in the subsequent processes, and from taking the dye uniformly, and well. The skin is then again softened and freed from the lime, by being thrown into a vat of bran and water, and kept there for some weeks, in a state of gentle fermentation, being occasionally returned to the beam. All the thickening produced by the lime is thus removed, and the skin is now as highly purified as possible, and is a thin extensible white membrane, called in this state a *pelt*, and is now fit for any subsequent operation of tawing, or dying, oil-dressing, or shammoying.

The method of bringing *kid* and *goat skins* to the state of *pelt*, is nearly the same as for *lambs*, except that the liming is used before the hair is taken off, the hair being of no great importance, and sold only to the plasterers; but the lamb's wool, which is more valuable,

would be injured by the lime. Kid's-skins will take a longer time in tanning, than lamb's.

If the pelts are to be *tawed*, they are then put into a solution of alum and salt, in warm water, in the proportion of about three pounds of alum, and four pounds of salt, to every 120 middle-sized skins, and worked therein, till they have absorbed a sufficient quantity. This again gives the skin a remarkable degree of thickness and toughness.

The skins are then taken out, and washed in water, and then again put into a vat of bran and water, and allowed to ferment for a time, till much of the alum and salt is got out, and the unusual thickening produced by them, is for the most part reduced. They are then taken to a lofty room, with a stove in the middle, and stretched on hooks, and kept there till fully dry. The skins are then converted into a tough, flexible, and quite white leather; but to give them a glossy finish, and to take off the harshness of feel still remaining, they are again soaked in water, to extract more of the salt, and put into a large pail, containing the yolks of eggs, beat up with water. Here the skins are trodden for a long time, by which they so completely imbibe the substance of the eggs, that the liquor above them is rendered almost perfectly limpid; after which they are hung up in a loft to dry, and finished by glossing with a warm iron. There are other smaller manipulations, which need not be here mentioned.

The essential difference, therefore, between *tanning* and *tawing*, is, that in the former case, the pelt is combined with tan, and other vegetable matter; and in the latter, with something that it imbibes from the alum and salt, (possibly alumine,) and which, certainly, is never again extracted, by the subsequent washing and branning.

The (so called) *Morocco leather*, prepared from sheep-skins chiefly, and used so largely for coach linings, pocket books, and the best kind of book-bindings, is thus made. The skin, cleansed and worked in the way already described, is taken from the lime-water, and the thickening, thereby occasioned, is brought down, not by bran liquor, as in tawing, but by a bath of dogs' or pigeons' dung, diffused in water, where it remains till sufficiently suppled, and till the lime is quite got out, and it becomes a perfectly white clean pelt. If intended to be dyed red, it is then sewed up very tight, in the form of a sack, with the grain side outwards, (the dye only being required on this side) and is immersed in a cochineal bath, of a warmth just equal to what the hand can support, and is worked about for a sufficient time, till it is uniformly dyed; a process that demands much skill and experience. The sack is then put into a large vat, containing sumach, infused in warm water, and kept for some hours, till it is sufficiently tanned.

The skins intended to be *blacked*, are merely sumached, without any previous dying. After some further preparation, the colour of the fine *red* skins being finished, with a weak bath of saffron, the skins, when dry, are grained and polished in the following way.—They are stretched very tight upon a smooth inclined board, and rubbed over with a little oil, to supple them. Those intended for black

leather, are previously rubbed over with an iron liquor, by means of a stiff brush, which, uniting with the gallic acid of the sumach, instantly strikes a deep and uniform black. They are then rubbed by hand, with a ball of glass, cut into a polygonal surface, with much manual labour, which polishes them, and makes them very firm and compact. Lastly, the *graining*, or ribbed surface, by which this kind of leather is distinguished, is given by rubbing the leather, very strongly, with a ball of box-wood, round the centre of which, a number of small equi-distant parallel grooves are cut in, forming an equal number of narrow ridges, the friction of which gives the leather the desired inequality of surface.

[TO BE CONTINUED.]

On an Improvement in hardening Steel Cutting-Instruments. By Mr. E. RHODES, *Cutler, of Sheffield, England.**

The next head of my subject, is, by far, the most important; though perhaps, the least attended to.—*The hardening and tempering of steel*, is a process extremely simple; it requires more of *care*, than skill; on which account, it is in general, performed by workmen very inadequately rewarded: yet, in the manufacturing of an edged instrument, much depends on the nice management of this very simple operation, which either imparts a value to, or renders nugatory, all the labour that precedes, and all that follows it.

Practically concerned, for upwards of forty years, in the hardening of steel; and having had the process to perform, repeatedly, upon the finest and most delicate cutlery (scissors) ever manufactured; having studied the subject with considerable attention; and having accurately observed and noted the result of facts, as they occurred; the writer presumes he may be permitted to speak, on this part of his subject, with confidence.

It is a generally prevailing opinion, amongst men accustomed to the management of this process, that if steel be overheated previous to immersion, an extra portion of heat is likewise required to reduce it, or what is termed *let it down*, to a proper degree of hardness; and that, without this, a good cutting edge cannot possibly be produced. This, to say the least of it, is a miserable and inefficient attempt to remedy one error, by the introduction of another. That this is an extremely injudicious opinion, and that it operates, perhaps, more than any other cause whatever, to produce a mass of inferior cutlery, must be obvious to every one, who thinks at all upon the subject. It may be laid down *as a position*, which is not in much danger of being controverted, that *the lowest possible heat, at which steel can be worked, and become hard, is indubitably the best; and that to impart to it any extra portion, is essentially to injure its most valuable properties.* If *overheated*, the pores of the steel become open and expanded, the firm-

* From his Essay on the Manufacture, Choice, and Management of a Razor.

ness of its texture is destroyed, *and it is rendered incapable of sustaining a cutting edge!* It must not, however, be inferred, from these remarks, that any degree of *temper* whatever, will operate to restore to steel the properties of which it has been deprived, by being *overheated.* Workmen, however, acting under the influence of the preposterous opinion here deprecated, manifest great carelessness in the performance of this very critical operation of hardening; always imagining, that the evil effects of this carelessness may be remedied, by resorting to a practice most evidently erroneous.

The reader is desired to keep in mind *the position* just laid down, that *the lowest possible heat, at which steel can be worked and hardened, is indubitably the best.* To men at all acquainted with the nature of steel, no argument will be necessary to establish this important fact: those who are not, may be referred to the foregoing, and the subsequent observations.

It has often been matter of regret to the writer, that *the phraseology of books and common life,* when applied to subjects intimately connected with a particular manufacture, furnishes no terms by which meaning can be so accurately expressed, as by *the technicals of the workshop:* these are always at hand, and the mind continually recurs to what it dare not use; it finds a task imposed upon it—not unlike that of translating from one language into another, in which the sense suffers by diffusion, and yet cannot possibly be compressed. It is, however, hoped, notwithstanding this difficulty, that the subject, here treated of, may be rendered sufficiently intelligible.

Articles manufactured of steel, for the purposes of cutting, are, almost without an exception, hardened from the anvil; in other words, they are taken from the forger to the hardener, without undergoing any intermediate process: such is the accustomed routine; but the mischief it occasions has either escaped observation, or is disregarded. The act of forging steel produces a strong scale, or coating, which spreads over the whole of the blade, &c.; and, to make the evil still more formidable, this scale, or coating, is unequal in thickness, varying *in proportion to the degree of heat communicated to the steel, in forging it;* it is, partially, nearly impenetrable to the action of water, when immersed in it, for the purpose of hardening. Hence it is, that different degrees of hardness prevail, in most razors manufactured: this is, evidently, a great defect; and so long as it continues to exist, a great difference of temper must exist likewise. Razor-blades not unfrequently exhibit the fact here stated, in a very striking manner: what are termed *clouds,* or parts of an unequal polish, derive their origin, chiefly, from this cause;* and clearly and distinctly, (or, rather, *distinctly,* though not *clearly*) show how far this partial coating has extended, and where the action of the water has been yielded to, and where resisted. It certainly cannot be matter of astonishment, that so few improvements have been made in the hardening of steel, when the evil here complained of so universally prevails, as almost

* These clouds are sometimes produced from the blade being heated too rapidly. Wherever they are observed, the razor is of unequal temper.

to warrant the supposition, that no attempt has ever been made to remove it. The remedy, however, is easy, and simple in the extreme; and so evidently efficient in its application, that it cannot but excite surprise, that, in the present highly improved state of our manufactures, such a communication should be made, as a discovery entirely new!

Instead, therefore, *of the customary mode of hardening the blade from the anvil, let it be passed, immediately, from the hands of the forger, to the grinder: a slight application of the stone, will remove the whole of the scale, or coating; and the razor will then be properly prepared, to undergo the operation of hardening, with advantage.* It will be easily ascertained, that steel, in this state, heats in the fire with greater regularity; and that, when immersed, the obstacles being removed, to the immediate action of the water on the body of the steel, the latter becomes equally hard, from one end to the other. To this may be added, that, *as the lowest possible heat, at which steel can be worked, and become hard, is indubitably the best;* so the mode here recommended, will be found to be the only one, *by which the process of hardening can be effected with a less portion of heat than is, or can be, required in any other way.* It has, likewise, another important advantage: it prevents the edge from being softened, by grinding on the *first*, or, as it is technically termed, the *dry stone;* a practice which generally prevails; and which frequently so injures the temper of the razor, as to render it an extremely unfit instrument for shaving. These observations are decisive; and will, in all probability, *tend to bring into general use a practice, which cannot but be regarded as a very important improvement, in the manufacture of edged steel-instruments.*

On the Choice and Management of a Razor. By the Same.

It is, certainly, of some importance, that what a man is under the necessity of doing *daily* should be done *well*, and *with as little inconvenience as possible.* Shaving with a *bad*, or even an *indifferent razor*, may properly be regarded as *one of the miseries of human life.* It is an operation which men rather submit to than solicit: it is occasionally attended with pain, and as it cannot be avoided, it is, at any rate, desirable to lessen its unpleasantness. Hence every *novelty*, in the form and make of a *razor*, or even of a *strop*, have hitherto been caught at with some degree of avidity; the delusions have had their day, and, in all probability, answered the purposes for which they were created.

A few remarks on the *weight* and *form* of a razor will suffice, its primary excellence consisting in qualities of another description; namely, in its regularity and fitness of *concavity*, its *hardness*, and the *durability* of its *edge*. Weight and form are, notwithstanding, of some importance, and entitled to particular attention. The length of a razor, which generally varies from four to five inches, if manu-

factured on regularly established principles, determines its relative weight. It is essential, that the thickness of the back of the blade, should bear a correspondent proportion to its breadth, which, generally speaking, should be as one to three and a half, though, indeed, this proportion may be permitted to vary a little; it should, however, be understood, that the farther it is departed from, the more unserviceable does the razor become; the reason is obvious: a razor is honed, or whetted, by resting equally upon the back and the edge; if, therefore, this operation be performed upon a narrow blade, with a disproportionately strong back, a short and thick edge is produced, not any way calculated to serve the purposes of shaving, with advantage. If, on the other hand, the blade be broad, and the back light, it is impossible to avoid forming a long and thin edge, which cannot be sustained for a moment, against the opposition of a strong beard. It is, therefore, evident, that justness of proportion, with respect to breadth and thickness, is more to be attended to, than length; this latter, indeed, is so entirely and completely matter of choice, that any observations upon it would be obviously superfluous. The strength or thickness, and of consequence, the weight of what workmen term the *tang*, or the finger-hold of the blade, is, likewise, a circumstance worthy of notice. A requisite proportion should here be preserved, otherwise the utility of the best manufactured razor may be considerably diminished: if thick and heavy, the weight of the cutting part of the blade is so much reduced, that great pressure is required to make it bear upon its work; if thin and light, similar to the razors manufactured in France, it cannot be held firm in the hand; each extreme should therefore be avoided: undue strength or weight in the handle, may, likewise, produce the former of these effects.

A question here naturally arises: how are the defects above alluded to, to be detected, by persons unaccustomed to the manufacturing of razors? If the eye, which almost instantly observes any thing approaching to disproportion in the parts, should in this instance be an insufficient guide, let the *hand* be resorted to; it may here prove a more competent detector. Thus, before a razor is purchased, let it be tried, in the same position in which it is held during the operation of shaving; if *thin* in the tang, it will soon be discovered that it cannot be maintained in a cutting direction, without a much stronger and firmer grasp, than ought to be employed on so delicate an occasion; if *thick* and *heavy*, though it may be held more easily and pleasantly, yet it cannot fail to be observed, that the cutting part of the blade will be so much over-balanced by the weight of the hand-hold, that here again, though from a completely opposite cause, considerable exertion will be necessary to apply the razor, with suitable effect.

Sensible of the advantage of a firm, and at the same time, an easy hold of a razor, some cutlers have recommended, that the sides at least, if not the whole of the tang, should be cut in the manner of a file; this rather detracts from the elegance, and the high finish, of the article, but its utility cannot be doubted.

Form is of equal consequence with weight, and not, by any means,

so dependent upon fancy, as is generally supposed; one form, at least, has decidedly the advantage of another.

Inequality of breadth, which necessarily includes a proportionate inequality of thickness in the back, is, however, liable to objections, that arise, chiefly, from the additional portion of care required in the course of manufacturing, and more particularly, in the very critical process, of hardening the razor; for, in communicating a requisite degree of heat to the thicker parts of the blade, the thinner, are frequently so much over-heated, that the whole razor is injured beyond remedy, and its utility effectually destroyed. It must be acknowledged, that the occurrence of this formidable evil may be prevented; but it is only by the exercise of more care and caution than are generally used.

A straight-edged razor is by no means adapted for general use. It is, in fact, fitted only for those, who, convinced that every cutting instrument, from a saw to a razor, is composed of a regular succession of teeth, or points, nearer or farther apart, have learned to distinguish between the operation of cutting, and what may, not inaptly, be denominated *scraping*. The latter is, however, the prevailing mode of shaving; it is the practice, in a greater or lesser degree, of almost every man who shaves himself; and as it is an evil which cannot be entirely removed, it must be partially provided against. How far this is within the power of the razor-maker, will, perhaps, appear from the following remarks. It may here be laid down as a principle, that whatever the form of the back of a razor may be, the edge should always describe a portion of a circle.

It must be tolerably evident to every man who thinks upon the subject, and who has paid attention to the manner in which a razor is commonly used, that the *circularly curved blade*, here recommended, even if applied in the very injudicious mode above alluded to, has decidedly the advantage, whether passed over the face obliquely from the point to the heel, or drawn forwards without the least obliquity of direction, that it must, of necessity, cut, even where a *straight-edged razor* would do nothing, but fret or tear the skin, without removing the beard.

After all, it must be admitted, that the advantage which a full-edged razor, has over a straight one, in point of cutting, arises chiefly from a very defective manner of shaving: so long, however, as this defect exists, so long will the full-edged razor claim a decided superiority. It often happens, that men, groaning under this very useful and necessary operation, attribute their bleeding, writhing, and contortions of face, to the badness of the razor, when the principal fault is in themselves.

Scraping is not precisely the same thing as *cutting;* and if, contrary to all good advice, a man will apply the whole edge of a razor to a part of his face, and draw it in a straight line downwards, as a butcher scrapes the bristles from the back of a hog, instead of giving it, at all times, an oblique and cutting direction, he will often find himself in an unpleasant situation, and all the abuse he can pour upon the instrument in his hand, will not furnish an effectual relief.

Form, *weight*, and *justness of proportion*, united with a proper degree of *hardness*, are certainly constituent parts of a *good razor;* yet its excellence depends likewise on its possessing a *regularity* and *fitness* of *concavity*. It is already almost generally known, that this regularity is produced in the process of grinding, by the use of stones of different diameters, varying from *four*, to *twelve* inches, according to the price of the article required; and it cannot have escaped observation, that this circumstance only, constitutes a very essential difference of edge.

The grinding of razor blades on a *four* inch stone, has recently so much prevailed, that a few remarks on its superior pretensions, may be admitted with propriety. It is easily discernible, that a razor, thus manufactured, must, of necessity, possess great thinness of edge; a circumstance which, independent of any other, renders it unfit for general purposes, even though it may be used in some cases with advantage: a strong wiry beard will put all its boasted excellence to the proof: here it will be found, that a less degree of concavity, and of consequence, a stronger and firmer edge, is indispensably necessary. From the observations here adduced, it appears that the concavity of the blade should, at all times, be regulated by the formidableness, or otherwise, of the object it has to encounter. Razors, however, ground upon stones of about *six* or *seven* inches diameter, may be recommended, as best adapted for general use; they are sufficiently hollowed, or ground out, for any service, however hard, to which they may be applied; and they combine a desirable strength and firmness of edge, with a requisite degree of thinness, provided that the strength of the back, and the breadth of the blade, are duly proportioned.

The *concavity* of a razor should likewise possess great evenness and regularity, otherwise a very unequal edge is produced, a defect which every application of the hone will rather increase than diminish, and which nothing but re-grinding, in a more perfect manner, can possibly remove. There is an appearance produced upon the blade of a new razor, by the use of the hone, which affords a certain criterion, by which this formidable imperfection may always be detected. Two lines are produced, the one upon the edge, and the other upon that part of the back, which rests upon the hone in whetting. On examining a razor, these lines are very apparent, and are easily distinguished by their difference of polish; in some razors they are very unequal, and present several variations in breadth, from heel to point; others possess an even, undeviating regularity; these different appearances should be noted with particular attention, as they afford a certain means, by which the most superficial observer may learn to detect defective workmanship in, *one* of the requisites of a good razor. It can hardly be necessary to add, that where this *evenness of line* exists, a *regularity of concavity* cannot, possibly, be wanting; nor where the contrary is the case, can a good cutting edge be expected.

After all that has been said, it must be admitted, that no infallible criterion can be established, by which all the defects that a razor may have, can, with certainty, be detected. Some, indeed, are exposed to observation; others are hidden, and evade it.

Razors were, in some respects, as well manufactured many years ago, as they are at present: it was, indeed, at one time, a principal object *to make razors for use.* Latterly, *they are made to sell, without any other consideration whatever!* Neither the quality of the material used, nor the excellence of workmanship, appears to be at all studied! A cheap and useless instrument is too frequently foisted upon the public; and the reputation of Sheffield manufactured cutlery, is grossly injured by the practice! Yet, amongst the mass of indifferent cutlery, now made in this ancient mart for hardware, many of its best articles, are of the first quality, and equal, if not superior, to any in the world.

Some new, and important, improvements in steel, have lately been attempted, which, if ultimately successful, will be of considerable advantage to the manufacturers of razors, and of every description of fine cutlery. Messrs. Stodart, F. R. S. and Mr. M. Faraday, chemical assistant in the Royal Institution, have made an interesting communication to the Royal Society of London, in which they detail a series of experiments, undertaken for the purpose of ascertaining how far the best refined steel may be improved, by an alloy of other metals. Some of these experiments appear to have been very successful in their results, and may, probably, at no very distant period, prove of essential service to the town of Sheffield. The application of chemical knowledge, to the improvement of the best refined steel, can hardly fail to be attended with beneficial consequences; this beautiful and highly useful metal, has been refined to a degree of purity and excellence, of which it was, at one time, thought utterly incapable; and let no one suppose, that it has attained the *maximum* of improvement; such a conclusion would be not only extremely unphilosophical, but injurious and absurd. The public are therefore indebted to those men, who, by patient and laborious investigation, discover the hidden properties, detect the chemical affinities of matter, and apply the secrets of nature to the useful purposes of life. Messrs. Stodart and Faraday pursued their inquiries patiently, under a num- of discouraging circumstances, and unsatisfactory results. The combinations they anticipated did not always take place; but they finally ascertained the exact proportions, necessary to produce complete and perfect alloys of steel, with silver, platina, &c. The former of these combinations, they say, produces a metal 'harder than the best cast-steel, or even than the Indian wootz; and the articles made of it, prove to be of a very superior quality.' They add, 'The silver alloy may be advantageously used, for almost every purpose for which good steel is required.'

Anxious to ascertain to what extent steel might be improved by the alloy of silver, as recommended by Messrs. Stodart and Faraday, I have undertaken a similar series of experiments, the results of which have all tended to establish the importance of their researches, and the accuracy of their conclusions. My next object was, to bring this improved steel into use, and establish its superiority, by the excellence of the articles to which it was applied. I have now, for nearly twelve months, used this improved steel in my manufactory, and, hitherto,

the razors into which it has been wrought, have, invariably, proved decidedly superior, for fineness and durability of edge, to any article previously introduced into the cutlery manufacture, in any part of the kingdom.

On the Honing and Stropping of a Razor.

Let the hone be seldom, and but sparingly resorted to; and never, unless by frequent and repeated stropping, the *edge* of the razor is entirely destroyed: use the best pale oil, and be careful to preserve the hone clean, and free from dust. Previously to the operation of shaving, it will be found of service, particularly to those who have a strong beard, and a tender skin, to wash the face well with soap and water; and the more time is spent in lathering, and moistening the beard, the easier will the process of shaving become. Dip the razor in hot water, before applying it to the face; use the blade nearly flat, always taking care to give it a *cutting*, instead of a *scraping*, direction. Strop the razor immediately after using it, for the purpose of effectually removing any moisture that may remain upon the edge; and be careful not to employ a *common strop*, as the composition with which they are covered, is invariably of a very inferior quality, and injurious to a razor. The strop should always be of the best manufacture, and when the composition is worn off, it will be found particularly useful to rub it over, lightly, with a little clean tallow, and then put upon it the top part of the snuff of a candle, which being a fine powder, will admirably supply the place of the best composition ever used for the purpose. Another excellent mode of renovating a razor-strop, is by rubbing it well with pewter, and impregnating the leather with the finest metallic particles.

In closing these observations, I cannot omit to protest against *the elastic cushion strop*, which, from easily yielding to the pressure of the razor, removes the *fine, keen, flat edge*, produced by the hone, and substitutes *an injurious roundness* in its place. A flat strop, not too much burthened with leather, is best adapted to continue the form, which the edge receives in honing; to admit of any other, is to subvert, in practice, the principles on which a good cutting edge is formed.

Influence of the Moon, on Animal and Vegetable Economy. *By Mr.* N. Mill.

(TO THE EDITORS OF THE ANNALS OF PHILOSOPHY.)

Gentlemen,—The subject of the moon's influence, has engaged but very little of the attention of the philosophical world, and with the exception of the theory of the tides, has been scarcely noticed. Its influence in promoting, and accelerating, animal decomposition, is known only to a certain class of persons, not the most renowned, indeed, for studying the doctrine of cause and effect, or extending

philosophical knowledge, but who, nevertheless, are sufficiently alive to interest; (namely,) persons in the Navy and Company's service. It is a fact well established and authenticated, by numbers of these gentlemen, who have experienced heavy losses thereby, that if an animal fresh killed, be exposed to the full effulgence of the moon, at certain seasons, and in certain places, a very few hours only, will be sufficient to render the animal so exposed, a mass of corruption; whilst another animal, not exposed to such influence, and only a few feet distant, will not be in the slightest manner affected. It would be impossible, in the present imperfect state of our knowledge of this luminary, and its influence, to draw any just conclusions from so few facts, as have been collected upon this subject; but it will be most desirable to accumulate them as much as possible, in order to deduce some accurate reasoning from them; I therefore subjoin some facts, which have come to my knowledge, of the highest practical importance to this maritime nation; and the disclosure of which, I trust, will open a field for investigation, that has, hitherto, been uncultivated, and neglected. The influence of the moon on vegetation, has not altogether been unobserved, because fruit, when exposed to moonshine, has been known to ripen much more readily, than that which has not; and plants shut out from the sun's rays, and from light, and consequently bleached, have been observed to assume their natural appearance, if exposed to the effulgence of the moon. These are also facts fully established, but from which no rational theory has been drawn. A very intelligent gentleman, named Edmonstone, who was for nearly 30 years engaged in cutting timber in Demerara, and who had made a number of observations on trees, during that period, has done me the favour to give me explicit answers to a series of queries, which I presented for his inspection; and which, I doubt not, will be appreciated as they merit. I shall present them in detail, with the answer to each.

Question.—1st. Influence of the moon on vegetation?

Answer.—I have paid but little attention to the moon's influence on any thing exposed to it, but trees; the moon's influence, however, on these, is very great. So observable is this, that if a tree should be cut down at full moon, it would immediately split, as if torn asunder, by the influence of a great external force applied to it. This separation of its parts takes place, I presume, owing to the immense quantity of juice which is contained in the body of the tree. In consequence of this, trees cut at full moon, are of comparatively little use; in a very short time after being cut down, they are attacked by a moth, somewhat similar to what is often found in American flour. Trees cut down at this season, are likewise attacked much earlier by the rot, than if allowed to remain to another period of the moon's age.

Question.—2nd. The nature of the trees?

Answer.—It is impossible to give, in this small space, a statement of the different trees to be met with in the West India Islands, and our Colonies in South America. They are as different as those are which we have in our own country, indeed by far more numerous.

Question.—3d. If evergreens?

Answer.—All the trees in those countries may be stiled evergreens, as there is a constant succession of leaves upon them all.

Question.—4th. Their names?

Answer.—With the scientific names of the various trees to be found in our colonies, in the West Indies and South America, I am unable to supply you. The names given to most of them, are Indian names, applied to them by the natives.

Question.—5th. If usually cut at particular, or in all seasons?

Answer.—The trees intended to be applied to durable purposes, are cut only during the first and last quarters of the moon, for the reasons mentioned in the answer to question 1.

Question.—6th. If the sap rises during the absence of the moon, or during its effulgence?

Answer.—The sap rises to the top of the tree at full moon, and falls in proportion to the moon's decrease.

Question.—7th. Whether common to all trees, or only to certain species?

Answer.—The influence of the moon, over the rising and falling of the juice of trees, is common to all the species of trees with which I am acquainted. I had occasion to observe these effects in the experience of 30 years, amongst the various kinds of wood with which the colonies of South America, abound.

From this statement, it appears obvious, that trees cut at the *full of the moon*, will *split*, as if torn asunder by great external force; that they are more liable to the *attacks of worms;* that they are attacked *much earlier by the rot; and that the sap rises to the top of the tree at full moon, and falls in proportion to the moon's decrease; and this effect is common to all species of trees* with which this gentleman was acquainted.

It will be perceived, that these observations are confined to the continent of South America, and islands adjoining; but if the moon has a correspondent influence in other countries, (which there is no reason to doubt,) and this gentleman's observations be correct, the practical importance of them in felling timber, deserves the utmost thanks, from those persons who are in any way interested in practices of this kind, as well as from society at large.

On changing the Residence of Fishes. By the Same.

(TO THE EDITORS OF THE ANNALS OF PHILOSOPHY.)

Gentlemen,—In reading Dr. Mac Culloch's paper on "Changing the Residence of certain Fishes," in the 54th number of the Quarterly Journal, I was impressed with the importance of the subject, to society; and, I conceive, that any facts which can be collected, in corroboration of his statements, cannot fail to be interesting, and useful. I therefore take the liberty to forward you some facts, which have come under my observation, respecting the habits of the salmon, and the

likelihood of its being domesticated (if I may use the expression) in fresh water lakes and ponds. The salmon has many peculiarities in its history, and mode of living, which are common to most of the finny tribe, that are inhabitants alike of fresh and salt water, and some which others have not. The salmon, during certain months of the year, is an inhabitant of fresh water rivers and lakes that communicate with the sea, and, apparently, for the sole purpose of depositing its ova or spawn. It then again betakes itself to the sea to recruit its strength and vigour, but, unlike other migratory fishes, its retreat cannot be traced; for it is a singular fact, that salmon have never been taken or seen in salt water far from the mouth of some river; and there, only at certain seasons of the year. The herring, the pilchard, the mullet, and the mackerel, may be followed from one sea to another, and from one creek to another; but not so with the salmon, whose *hiding-place* is a mystery, yet to be solved by naturalists. The general opinion, entertained upon this subject, is, that they do not wander far from the shores of the fresh water rivers they frequent, from the well known fact that the *same* salmon will always return to the *same river* to deposit its spawn; and if they do migrate to the northern seas (which some naturalists maintain) where they are found in abundance, but always, it must be remembered, in communication with some fresh water lake or river, it is giving the species credit for greater sagacity than we usually find amongst the animal creation. In ascending fresh water rivers, they surmount the most surprising difficulties; wears or dams of 15 feet in perpendicular height do not present an effectual obstacle to their progress, they are enabled by a spring or leap to pass them with ease. After having deposited their spawn, they become lean and covered with vermin, and fishermen assert, unless then suffered to return to the sea, they die; but this is one of the vulgar notions, which it is my business to controvert. In order to ascertain whether sea water was necessary for the existence and growth of the salmon, I caught some of the fry of this fish, as they were retreating to the sea, with an artificial fly; and preserved them alive, in order to transport them to a fish-pond, the dimension of which was about 30 yards square, with a clay bottom covered with mud; the depth of the water, was from three to four feet, and the pond supplied with a running stream; when first caught, they measured from the tip of the nose, to the tip of the tail, four inches: about twelve months afterwards, the pond was overflowed, when some of the fish, together with some trout, were left dry; they now measured in length eight inches, and assumed the shape, and appearance, of a lean salmon. If, therefore, the young salmon will live for twelve months, in a space of thirty yards square, and three feet deep, and increase in size, the presumption is, that in water where it may range at large, and procure that food and situation which are most congenial to its habits, it would attain its usual size. In propagating this fish in fresh water, the greatest facility presents itself, by transporting its ova or spawn, which is readily discovered in places frequented by salmon, to the places intended for its propagation, choosing, as nearly as possible, the same situation, as that from which it has been removed.

The Chinese, far exceed even the ancient Romans, in the care they bestow upon the propagation of the finny tribe. At certain seasons of the year, they carefully collect all the ova as fast as it is deposited by the fishes, to prevent its being devoured by the other tribes; they then procure some eggs, and, after making a hole in each end, and blowing the inside of it through, the ova is introduced; and the ends being closed, the egg is placed in an oven of a certain temperature, until the young fry nearly make their appearance, when the shell is broken, and the contents put into water warmed by the sun's rays. When the young brood, procured by this means, attain a certain size, a portion of it is applied for the purposes of food for the larger species of fish, and the remainder is destined for the table.

Your obedient servant, N. MILL.

On the Ingots of Copper obtained by solution. By M. CLEMENT.

The beautiful experiments of Sir James Hall, have demonstrated that pulverized carbonate of lime, a substance eminently decomposable by heat, may be fused, under great pressure, without losing its carbonic acid, and afford, when cold, a solid mass similar to marble.

In like manner, as it was heretofore imagined, that that mineral was necessarily formed by deposition, from its aqueous solution, and could, by no means, be a product of heat; so, at present, it is generally believed, that a solid mass of metallic copper, capable of extension, under the hammer, must have undergone igneous fusion, and have acquired its cohesion by cooling. Copper, precipitated from its solution, by whatever agent, is always in the state of a fine loose powder. The following fact, however, will show that an ingot of copper may be formed *viâ humidâ*. I am indebted to M. Mollerat for the observation, which he communicated to me a short time since, on my visiting his fine manufactory for making vinegar from wood, in Burgundy.

In a series of operations for preparing sulphate of copper by calcining copper with sulphur, solutions of the sulphate are obtained, which become turbid by the separation of an insoluble subsulphate. They are placed in a tub, half buried in the ground, in order to become clear. It is against the interior sides of this tub, and always at the junction of two staves, that small buttons (*champignons*) of metallic copper are observed to form, which gradually increase in size, and would, doubtless, ultimately become considerable masses. I have some specimens, which I detached from the tub, with a portion of the wood adhering to them.

On one side we find these bits of copper moulded on the wood of the tub, whose striæ are impressed on their surface; on the other, they have the form of mammellæ with very minute, brilliant, crystalline facets.

One of these specimens weighs more than 75 grammes (nearly 2½ oz. English.)

The chemical action, by which the copper is revived, is easily explained. The protosulphate of copper, which, unquestionably, exists in the solution, in passing to the state of deutosulphate, deposits its base, which gives up its oxygen, and acid, to form the new salt. It is evident that the revival of the copper may be effected, in this manner, without the assistance of any iron, and, in fact, there are no traces of that metal in the interior of the tub. It is not, however, this part of the phenomenon, that appears to me most remarkable, but the cohesion, acquired by the copper, so precipitated, from the midst of a solution; a cohesion, which is so great as to allow the metal to be hammered in the cold, and reduced to thin leaves; and whose specific gravity is equal to that of fused copper, viz. 8.78. I have, moreover, filed a morsel of this copper, and have produced a surface as brilliant, and free from pores, as could have been obtained, by similar means, with an ingot of common copper. [*Annales de Chimie.*

On the Structure of Pearls, and on the Chinese Mode of producing them of a large Size, and regular Form. By JOHN EDWARD GRAY, MGS.

(TO THE EDITORS OF THE ANNALS OF PHILOSOPHY.)

Gentlemen,—Pearls are merely the internal pearly coat of the shell, which has assumed, from some extraneous cause, a spherical form; they are, like the shell, composed of concentric coats, formed of perpendicular fibres; consequently, when broken, they exhibit concentric rings and fibres, radiating from a central nucleus, usually consisting of a grain of sand, or some other body which has irritated the animal. A pearl having been once formed, the animal continues to increase its size, by the addition of fresh coats, perhaps more rapidly deposited on it, than on the rest of the shell, as the prominence remains a source of irritation.

The pearls are usually of the colour of the part of the shell to which they are attached. I have observed them white, rose coloured, purple, and black, and they are said to be sometimes of a green colour; they have also been found of two colours, that is, white, with a dark nucleus; which is occasioned by their being first formed on the dark margin of the shell, before it is covered with the white and pearly coat of the disk, which, when it becomes extended over them and the margin, gives them that appearance.

Pearls vary greatly in their transparency. The pink are the most transparent; and in this particular, they agree with the internal coat of the shell from which they are formed, for these pearls are only formed on the pinnæ, which internally are pink, and semitransparent; and the black and purple specimens are, generally, more or less opaque.

Their lustre, which is derived from the reflection of the light from their peculiar surface, produced by the curious disposition of their fibres, and from their semitransparency and form, greatly depends on

the uniformity of their texture, and the colour of the concentric coats, of which they are formed. That their lustre does depend on their radiating fibres, may be distinctly proved, by the inequality of the lustre of the "Columbian pearls," which are filed out of the thick part, near the hinge of the pearl oyster, *Avicula Margaritifera*, so that they are formed like that shell, of transverse laminæ; and consequently exhibit a plate of lustre on one side, which is usually flat, and are surrounded by brilliant concentric zones, which show the places of the other plates, instead of the even, beautiful, soft lustre of the true pearls.

Some time ago, in examining the shells in the British Museum, I observed a specimen of *Barbala plicata*, with several very fine regular shaped semiorbicular pearls of most beautiful water, and on turning to their superb collection of pearls, I found several fragments of the same shell, with similar pearls; and on the attentive examination of one of them, which was cracked across, I observed it to be formed of a thick coat, consisting of several concentric plates, formed over a piece of mother of pearl, roughly filed into a plano-convex form, like the top of a mother-of-pearl button. On examining the other pearls, they all appeared to be formed on the same plan. In one or two places, where the pearl had been destroyed or cut out, there was left in the inside of the shell, a circular cavity with a flat base, about the depth, or rather less, than the thickness of the coat that covered the pearls, which distinctly proves, that these pieces of mother-of-pearl must have been introduced when the shells were younger and thinner; and the only manner that they could have been placed in this part of the shell, must be by the introduction of them between the leaf of the mantle, and the internal coat of the shell; for they could not have been put in through a hole in the shell, as there was not the slightest appearance of any injury, near the situation of the pearls, on the outer coat.

Since these observations, I have tried the experiment of introducing some similar pieces of mother-of-pearl (which may now be truly so called) into the shell of the *Anodonta Cygneus*, and *Unio Pictorum*, which I have again returned to their natural habitation; and I am in hopes, that some persons, who have more convenience, and are better situated for the purpose, will repeat these experiments, especially with the *Unio Margaritifera*. I found the introduction of the basis of the pearl, attended with very little difficulty, and I should think, very little absolute pain to the animal; for it is only necessary that the valves of the shell should be forced open to a moderate breadth, and so kept for a few seconds, by means of a stop, and that then the basis should be introduced between the mantle and the shell, by slightly turning down the former part, and pushing the pieces to some little distance, by means of a stick, when the stop may be withdrawn, and the animal will push the basis into a convenient place, by means of its foot, and of the 30 or 40 bases which I thus introduced, only one or two were pushed out again, and these I do not think had been introduced sufficiently far. In several which I afterwards destroyed,

I found that the bases were always placed near the posterior slope of the shell, where the pearls are situated in the *Barbala*.

If this plan succeed, of which I have scarcely any doubt, we shall be able to produce any quantity, of as fine pearls, as can be procured from abroad. My reason for believing that this manner of forcing the animals of the freshwater bivalves to produce pearls, is the invention of the Chinese, a nation celebrated for their deceptions and trick, is, that in looking over the collection of shells of Mr. G. Humphreys, I observed that a shell of this species, (the second perfect one that I have seen,) was marked as having come from China.

This plan, at least, is certainly much preferable to the one proposed by Linnæus, and by the above quoted anonymous author, as the pearls are all of a regular form, and that, the one best suited for setting. In cutting these pearls from the shell, it is necessary that the shell should be cut through, so that the mother-of-pearl button may be kept in its place; for if the back were removed, as it would be, were not the shell cut through, the basis would fall out, and then the pearl would be very brittle. The only objection that can be adduced against these pearls, is, that their semiorbicular, and unequally coloured sides, preclude them from being strung, or used any other way than set; but this will always be the case with all artificially produced pearls, as the mantle can only cover one side of them; and the only pearls that well answer the purpose of stringing, are those found imbedded in the cells, in the mantle of the animal.

Note.—Since the above was written, my friend, Mr. Children, has pointed out to me a paragraph, in the Encyclopædia Britannica, vol. vi. p. 477, in which it is stated, "Pearls are also produced by another artificial process. The shell is opened with great care, to avoid injuring the animal, and a small portion of the *external surface of the shell is scraped off*. In its place is inserted a *sphærical* piece of mother-of-pearl, about the size of *a small grain of shot*. This serves as a nucleus, on which is deposited the pearly fluid, and in time forms pearl. Experiments of this kind, have been made in Finland, and have been repeated in other countries."

On the Influence of Solar Light on the Process of Combustion. By Thomas M'Keever, M. D.

There is an opinion prevalent in this, and, I have reason to believe, in other countries, that the sun's rays, or even the ordinary light of day, when admitted freely into an apartment in which a common fire is burning, have the power of dulling it considerably, or should the combustion be going on languidly, of altogether effecting its extinction. Hence, it is a common practice to place screens of different kinds before the fire-place, or to close the shutters of the apartment, in order to prevent, as much as possible, the access of light to the burning materials. I was for a long time impressed with the belief that this was merely a piece of popular prejudice, for which there ex-

isted no rational foundation, whatever, or that, at furthest, the appearances might be owing to the retina having become less sensible to the comparatively feeble rays emitted by a body in a low state of combustion, while already under the influence of a stronger light.* But, as opinions, so generally entertained, usually rest more or less on observation and experience, the best sources of evidence in all such cases, and, as I was unable to procure any information whatever on the subject from the several works on chemistry which I have had an opportunity of consulting, I was induced, during the late summer, when we had such an unusual succession of steady sunshine, to make the following experiments.

Exper. 1.—Two portions of green wax taper, each weighing ten grains, were both ignited at the same moment; one of them I placed in a darkened room, the other I exposed to broad sunshine in the open air: thermometer, in sun, 78° Fahr.; in room 67°; loss as follows:†

In five minutes that placed in sunshine lost ..... 8½ grs.
darkened room lost 9¼

Exper. 2.—Two portions of taper, each weighing 23 grains, were placed, under similar circumstances, as in the former experiment.

In seven minutes that placed in sunshine lost ..... 10 grs.
darkened room lost .. 11

We here see, notwithstanding the higher temperature to which the taper in sunshine was exposed, which must, of course, have favoured the liquefaction of the wax, and, consequently, its ascent in the wick, that, during the short period of seven minutes, there was a difference of loss amounting to not less than one grain.

Exper. 3.—A common mould candle, fourteen inches in length, and three in circumference, was accurately divided into inches, half-inches, and eighths, and exposed, in the first instance, to strong sunshine: thermometer 80° Fahr.; atmosphere, remarkably calm.

To consume one inch, it took	59′	0″
In darkened room (temp. 68° F.)	56	0
In ordinary light of day (temp. 68° F.) ..	57	10

Exper. 4.—A piece of taper, seven inches in length, and six-eighths of an inch in circumference, was carefully divided into inches, and, as in former experiment, submitted to bright sunshine: thermometer 79°.

To consume one inch, it took	5′	0″
Transferred to darkened room (temp. 67°)	4½	0
In ordinary light of day (temp. 67°)	4	52

* Hence it is that the strongest light appears to produce the deepest shadow. A total eclipse of the sun occasions a more sensible darkness than midnight, being more immediately contrasted with the strong light of noon-day.

† I should mention that in all these experiments the snuff was carefully removed with a sharp scissors, whenever a quarter of an inch of taper was consumed. This was obviously necessary, as the length of the snuff is known materially to influence the rate of combustion.

Exper. 5.—In order to vary the experiment, and to guard, as much as possible against the agitation of the surrounding atmosphere, I procured two lanterns; one of them I coated with black paint; the other I left naked. In these I placed two portions of taper, of precisely equal weights, and exposed them both to a strong glare of sunshine.

In 10 minutes that placed in painted lantern lost .... 16½ grs.
that placed in uncoated lantern lost ... 15*

Exper. 6.—With the view of ascertaining whether similar results were to be obtained by exposure to the light of the moon, I prepared the lanterns as in the last experiment, and took an opportunity, lately, when this luminary shone forth with peculiar splendour, of trying its effects; but, although I employed an exceedingly delicate balance for the purpose, I could detect no difference whatever in the loss sustained by the two portions of taper. [*Annals of Philosophy.*

The remainder of this paper is principally devoted to theoretical considerations, which we have omitted. The truth of the common opinion, respecting the effect of Solar Light upon combustion, appears to be clearly established by the foregoing experiments; a result, it is believed, not anticipated by the Philosopher.

ON GILDING, SILVERING, AND TINNING.

FROM NICHOLSON'S OPERATIVE MECHANIC.

In our second, and third numbers, we have furnished extracts from "The Operative Mechanic," a work of uncommon excellence, recently published in England, by John Nicholson. Messrs. Carey & Lea, of this city, are about to republish it, with considerable additions. The volume consists of about 800 pages, with nearly 100 plates. The American edition will contain 5 or 6 plates of machines, invented in this country, which are not to be found in the original. The mechanic or manufacturer cannot add to his library, a book of greater *practical* utility, than that which is now offered. Particulars may be seen in the prospectus, at the end of this number.

Some of the processes contained in the following extract, will, hereafter, be given more in detail.—Editor.

Gold powder for Gilding.—Gold powder may be prepared in three different ways:—1st, put into an earthen mortar, some gold-leaf, with a little honey, or thick gum-water, and grind the mixture till the gold is reduced to extremely minute particles. When this is done, a little warm water will wash out the honey or gum, leaving the gold behind, in a pulverulent state.

2nd.—Dissolve pure gold (or the leaf,) in nitro-muriatic acid, and

* The diminished rate of consumption in this experiment was, probably, owing to the want of a free current of air through the interior of the lantern.

then precipitate it by a piece of copper, or by a solution of sulphate of iron. The precipitate (if by copper,) must be digested in distilled vinegar, and then washed, (by pouring water over it repeatedly,) and dried. This precipitate will be in the form of a very fine powder: it works better, and is more easily burnished, than gold leaf ground with honey, as above.

And 3d, or the best method of preparing gold powder, is by heating a prepared amalgam of gold, in an open clean crucible, and continuing the strong heat, until the whole of the mercury is evaporated; at the same time constantly stirring the amalgam with a glass rod. When the mercury has completely left the gold, the remaining powder is to be ground in a Wedgewood's mortar, with a little water, and afterwards dried. It is then fit for use.

Although the last mode of operating has been here given, the operator cannot be too much reminded of the danger attending the sublimation of mercury. In the small way here described, it is impossible to operate without danger; it is, therefore, better to prepare it according to the former directions, than to risk the health by the latter.

To cover Bars of Copper, &c. with Gold, so as to be rolled out into Sheets.—This method of *gilding*, was invented by Mr. Turner, of Birmingham. Mr. Turner first prepares ingots or pieces of copper, or brass, in convenient lengths and sizes. He then cleans them from impurity, makes their surfaces level, and prepares plates of pure gold, or gold mixed with a portion of alloy, of the same size as the ingots of metal, and of suitable thickness. Having placed a piece of gold upon an ingot intended to be plated, he hammers and compresses them both together, so that they may have their surfaces as nearly equal to each other as possible; and then binds them together with wire, in order to keep them in the same position during the process required to attach them. Afterwards, he takes silver filings, which he mixes with borax, to assist the fusion of the silver. This mixture he lays upon the edge of the plate of gold, and next to the ingot of metal. Having thus prepared the two bodies, he places them on a fire, in a stove or furnace, where they remain until the silver and borax, placed along the edges of the metals, melt, and until the adhesion of the gold with the metal, is perfect. He then takes the ingot carefully out of the stove. By this process, the ingot is plated with gold, and prepared ready for rolling into sheets.

To Gild in Colours.—The principal colours of gold, for gilding, are red, green, and yellow. These should be kept in different amalgams. The part which is to remain of the first colour, is to be stopped off with a composition of chalk and glue; the variety required, is produced by gilding the unstopped parts with the proper amalgam, according to the usual mode of gilding.

Sometimes the amalgam is applied to the surface to be gilt, without any quicking, by spreading it with aqua-fortis; but this depends on the same principle as a previous quicking.

Grecian Gilding.—Equal parts of sal-ammoniac and corrosive sublimate, are dissolved in spirit of nitre, and a solution of gold made

with this menstruum. The silver is brushed over with it, which is turned black, but, on exposure to a red heat, it assumes the colour of gold.

To dissolve Gold in Aqua-Regia.—Take an aqua-regia, composed of two parts of nitrous acid, and one of marine acid; or of one part of sal-ammoniac, and four parts of aqua-fortis; let the gold be granulated, put into a sufficient quantity of this menstruum, and exposed to a moderate degree of heat. During the solution, an effervescence takes place, and it acquires a beautiful yellow colour, which becomes more and more intense, till it has a golden, or even orange colour. When the menstruum is saturated, it is very clear and transparent.

To gild Iron or Steel with a solution of Gold.—Make a solution of 8 ounces of nitre and common salt, with 5 ounces of crude alum, in a sufficient quantity of water; dissolve half an ounce of gold thinly plated and cut; and afterwards evaporate to dryness. Digest the residuum in rectified spirit of wine, or æther, which will perfectly abstract the gold. The iron is brushed over with this solution, and becomes immediately gilt.

To Gild, by dissolving Gold in Aqua-Regia.—Fine linen rags are soaked in a saturated solution of gold in aqua-regia, gently dried, and afterwards burnt to tinder. The substance to be gilt, must be well polished; a piece of cork is first dipped into a solution of common salt in water, and afterwards into the tinder, which is well rubbed on the surface of the metal to be gilt, and the gold appears in all its metallic lustre.

Amalgam of Gold, in the large way.—A quantity of quicksilver is put into a crucible, or iron ladle, which is lined with clay, and exposed to heat, till it begins to smoke. The gold to be mixed should be previously granulated, and heated red hot, when it should be added to the quicksilver, and stirred about with an iron rod, till it is perfectly dissolved. If there should be any superfluous mercury, it may be separated, by passing it through clean soft leather; and the remaining amalgam will have the consistence of butter, and contain about 3 parts of mercury to 1 of gold.

To Gild by Amalgamation.—The metal to be gilt, is previously well cleaned on its surface, by boiling in a weak pickle, which is a very dilute nitrous acid. A quantity of aqua-fortis is poured into an earthen vessel, and quicksilver put therein; when a sufficient quantity of mercury is dissolved, the articles to be gilt are put into the solution, and stirred about with a brush, till they become white. This is called quicking. But, as during quicking by this mode, a noxious vapour continually arises, which proves very injurious to the health of the workmen, they have adopted another method, by which they, in a great measure, avoid that danger. They now dissolve the quicksilver in a bottle, containing aqua-fortis, and leave it in the open air during the solution, so that the noxious vapour escapes into the air. Then a little of this solution is poured into a basin, and with a brush dipped therein, they stroke over the surface of the metal to be gilt, which immediately becomes quicked. The amalgam is now applied by one of the following methods:—

1st. By proportioning it to the quantity of articles to be gilt, and putting them into a white hat together, working them about with a soft brush, till the amalgam is uniformly spread.

Or, 2ndly. By applying a portion of the amalgam upon one part, and spreading it on the surface, if flat, by working it about with a harder brush.

The work, thus managed, is put into a pan, and exposed to a gentle degree of heat; when it becomes hot, it is frequently put into a hat, and worked about with a painter's large brush, to prevent an irregular dissipation of the mercury, till, at last, the quicksilver is entirely dissipated by a repetition of the heat, and the gold is attached to the surface of the metal. This gilt surface is well cleaned by a wire brush, and then artists heighten the colour of the gold by the application of various compositions; this part of the process is called COLOURING.

To gild Glass and Porcelain. No. 1.—Drinking, and other glasses, are sometimes gilt on their edges. This is done, either by an adhesive varnish, or by heat. The varnish is prepared by dissolving in boiled linseed oil, an equal weight, either of copal, or amber. This is to be diluted by a proper quantity of oil of turpentine, so as to be applied, as thin as possible, to the parts of the glass intended to be gilt. When this is done, which will be in about twenty-four hours, the glass is to be placed in a stove, till it is so warm as almost to burn the fingers when handled. At this temperature, the varnish will become adhesive, and a piece of leaf gold, applied in the usual way, will immediately stick. Sweep off the superfluous portions of the leaf, and when quite cold, it may be burnished, taking care to interpose a piece of very thin paper (India paper) between the gold and the burnisher. If the varnish is very good, this is the best method of gilding glass, as the gold is thus fixed on more evenly, than in any other way.

No. 2.—It often happens, when the varnish is but indifferent, that by repeated washing, the gold wears off; on this account, the practice of burning it in, is sometimes had recourse to.

For this purpose, some gold powder is ground with borax, and in this state applied to the clean surface of the glass, by a camel's hair pencil; when quite dry, the glass is put into a stove, heated to about the temperature of an annealing oven; the gum burns off, and the borax, by vitrifying, cements the gold, with great firmness, to the glass; after which it may be burnished. The gilding upon porcelain is, in like manner, fixed by heat, and the use of borax; and this kind of ware being neither transparent, nor liable to soften, and thus to be injured in its form in a low red heat, is free from the risk and injury, which the finer and more fusible kinds of glass, are apt to sustain from such treatment. Porcelain, and other wares, may be platinised, silvered, tinned, and bronzed, in a similar manner.

To gild Leather.—In order to impress gilt figures, letters, and other marks upon leather, as on the covers of books, edgings for doors, &c. the leather must first be dusted over with very finely pow-

dered yellow resin, or mastich gum. The iron tools or stamps are now arranged on a rack, before a clear fire, so as to be well heated, without becoming red hot. If the tools are *letters*, they have an alphabetical arrangement on the rack. Each letter, or stamp, must be tried as to its heat, by imprinting its mark on the raw side of a piece of waste leather. A little practice will enable the workman to judge of the heat. The tool is now to be pressed downwards, on the gold leaf; which will, of course, be indented, and show the figure imprinted on it. The next letter, or stamp, is now to be taken, and stamped in like manner, and so on with the others; taking care to keep the letters in an even line with each other, like those in a book. By this operation, the resin is melted; consequently, the gold adheres to the leather: the superfluous gold may then be rubbed off by a cloth; the gilded impressions remaining on the leather. In this, as in every other operation, adroitness is acquired by practice.

The cloth alluded to, should be slightly greasy, to retain the gold wiped off; (otherwise there will be a great waste in a few months,) the cloth will thus be soon completely saturated, or loaded with the gold. When this is the case, these cloths are generally sold to the refiners, who burn them, and recover the gold. Some of these afford so much gold by burning, as to be worth from a guinea, to a guinea and a half.

To gild Writings, Drawings, &c. on Paper or Parchment.—Letters written on vellum or paper, are gilded in three ways: in the first, a little size is mixed with the ink, and the letters are written as usual; when they are dry, a slight degree of stickiness is produced by breathing on them, upon which the gold leaf is immediately applied, and by a little pressure, may be made to adhere with sufficient firmness. In the second method, some white lead or chalk is ground up with strong size, and the letters are made with this, by means of a brush: when the mixture is almost dry, the gold leaf may be laid on, and afterwards burnished. The last method is, to mix up some gold powder with size, and to form the letters of this, by means of a brush. It is supposed, that this latter method, was that used by the monks in illuminating their missals, psalters, and rubrics.

To gild the edges of Paper.—The edges of the leaves of books and letter paper, are gilded, whilst in a horizontal position, in the bookbinder's press, by first applying a composition formed of four parts of Armenian bole, and one of candied sugar, ground together with water, to a proper consistence, and laid on by a brush, with the white of an egg. This coating, when nearly dry, is smoothed by the burnisher; which is generally a crooked piece of agate, very smooth, and fixed in a handle. It is then slightly moistened by a sponge, dipped in clean water, and squeezed in the hand. The gold leaf is now taken up on a piece of cotton, from the leathern cushion, and applied on the moistened surface. When dry, it is to be burnished by rubbing the agate over it, repeatedly, from end to end, taking care not to wound the surface by the point of the burnisher. A piece of silk or India paper, is usually interposed between the gold and the burnisher.

Cotton wool is generally used by bookbinders, to take the leaf up from the cushion; being the best adapted for the purpose, on account of its pliability, smoothness, softness, and slight moistness.

[TO BE CONTINUED.]

On the Superiority of the Straw-Paper, made by Mr. Louis Lambert's new patent process, over that formerly made by Mr. Matthias Koops.

Mr. Koops took out a patent for making paper from straw, upwards of twenty years since; the manufactory was first established at the Neckinger Mill, at Bermondsey; and afterwards removed to the Thames Bank, Chelsea, where it terminated unsuccessfully.

We cannot wonder at this failure, when we consider that his process consisted in merely steeping the straw, previously cut into pieces of about two inches long, in *cold* lime-water, and afterwards subjecting it to the *cutting* action of the paper mill; and the produce, after all, was a harsh, coloured paper; which never came into general use.

Mr. Lambert, on the contrary, merely frees his straw from the knots, and then submits it to *ebullition*, either with quicklime in water, or with caustic potash, soda, or ammonia, in order to extract the colouring matters, and dispose it to become fibrous; he then washes it, and next exposes it to the action of a hydro-sulphuret, composed of quicklime and sulphur in solution, in proper proportions of the quicklime, sulphur, and water (as indicated in the specification of his patent, published in page 92 of this Journal,) in order to free it from the mucilaginous and *silicious* matters, so prejudicial in paper making. He then washes it thoroughly, in successive portions of water, by exposing it to the *beating* (not *cutting*) action of the paper mill, till all smell of the alkaline sulphuret is entirely removed; he then presses it, and afterwards submits it to the usual operations employed in bleaching vegetable fibres, viz. to the action of chlorine, either separate, or in combination with lime; or by exposure to the open air and light, upon the grass. It is, lastly, exposed to the action of the rag engines usually employed in paper making, in order to reduce it into paste or pulp, previous to being made into paper.

The produce of this superior process, is a *soft white pulp*, fit for making *fine paper*, and very different indeed from the *harsh, coloured paper*, made under Mr. Koops' patent. [*Tech. Rep.*

A Process to render Cloth and Silk Water Proof. By M. COLLET.

The silk, or cloth, must be spread upon a wooden frame, and immersed or soaked with the following mixture: linseed oil, one pound, white lead, one ounce and a half, umber, one ounce, and a clove of garlic. The whole of these ingredients must boil for twelve hours,

on a small fire, and when the composition is perfectly fit for use, the surface will put on the appearance of skin.

The cloth, after having been immersed in, or washed with this composition, is to be hung up to dry, and when that is effected, to be rubbed with pumice stone to render it smooth. It is then to be coated with another thick fluid, composed of linseed oil, one pound, vitreous oxide of lead, one ounce, sulphate of zinc, four drams, and white lead, calcined till it has changed yellow, four ounces. These must be previously boiled together in an iron pot, until the material have the consistence of paste; the composition is then to be spread equally over the right side of the cloth; the material is then dried upon the fabric, in a chamber heated to forty or fifty degrees; it is necessary to repeat the operation twice for silk, and the result will be the production of an oil skin cloth, which will be water proof, and not rub nor wash off.

RAPID DISTILLATION.

Professor Oersted has pointed out a method of considerable utility in the evaporation of liquids. He fastens together a great number of fine metallic rods or wires, and puts them in the bottom of the still, or evaporating vessel, and by this means he distils seven measures of brandy with the same fuel, which, without the rods, would distil only four.

MOREY'S NEW VAPOUR ENGINE.

Samuel Morey, Esq. a gentleman whose name is familiar to those who have devoted their attention to mechanical science, has obtained a patent for a vapour engine, which, in the opinion of competent judges, promises to answer well, in practice. The vacuum in the cylinder, is produced, by firing an explosive mixture of atmospheric air, and vapour from common proof spirits, mixed with a small portion of spirits of turpentine. A working model has been set in motion, and kept at work, without elevating the temperature of the fluid, from which the vapour is produced, to a higher degree than that of blood heat. Should no unforeseen difficulties present themselves, in its operation on a large scale, it will be the greatest improvement which has been made for many years, particularly in its application to locomotive engines; as the weight of the materials required, to keep it in action for a considerable length of time, will be so small, as not to be worth mentioning.

A gentleman has gone to England, for the purpose of obtaining a patent in that country.

BORING FOR WATER.

Mr. Disbrow, who has been for some time engaged in boring for water, on the land of Mr. John H. Bostwick, in the neighbourhood of

New Brunswick, in the state of Jersey, has met with complete success. Before inserting a tube, the water rose to the height of about two feet above the surface; since the orifice has been so secured, it rises to the height of six feet, and would, if necessary, ascend still higher.

The discharge, at six feet above the ground, is about a gallon and a half, per minute; and at half that height, the quantity is doubled. The depth bored, was from 240 to 250 feet. This, we understand, is the fourth instance, in which this gentleman has succeeded in obtaining water, in the same neighbourhood. We hope that Mr. Disbrow, or some other person acquainted with the whole procedure, will furnish particulars on this interesting subject, either through the medium of this Journal, or in some other way, in which they may be made public.

AMERICAN TYPOGRAPHY AND ENGRAVING.

The following notice of the state of these arts in the United States, is translated from the volume of the *Revue Encyclopédique*, for Jan. 1826; a work of high literary merit and reputation, published in Paris.

"American Ornithology, by *Charles Lucien Bonaparte*. This work is the most remarkable which has issued from the American press, for the richness both of its typography and engravings; and is, perhaps, not inferior in either of these particulars, to any work of a similar kind, which has been printed in Europe."

This remark, as liberal as it is just, derives no small value, from the circumstance of its having been made in a city, where these arts have attained a high degree of perfection, and by those who are competent to pronounce a correct opinion.

FRANKLIN INSTITUTE.

Philadelphia, April 20, 1826.

The ninth quarterly meeting of the Franklin Institute, was held at the new Hall—the President in the chair, and S. V. Merrick was appointed Secretary.

The following Report was received from the Board of Managers, adopted, and ordered to be printed. Adjourned,

S. V. Merrick, Secretary.

To the Franklin Institute, of the State of Pennsylvania, the board of managers respectfully present the following report of their proceedings during the quarter which has just expired.

The first meeting of the board, after the annual election, was held on the 21st of January, when the board was organized, and Thomas Fletcher was chosen chairman, and John R. Warder, Clerk, for the current year.

The building of the hall has advanced with rapidity, and is expect-

ed to be completed in two months. The District Court of the United States have taken possession of their apartments; and the board have held their meetings in one of the rooms, since the beginning of March.

The lectures of the season, have been brought to a close. Three regular courses were given—one on Chemistry, by Mr. Keating, one on Mechanics, by Dr. Jones, and one on Natural History, by Dr. Godman. Besides these, however, many lectures were delivered by different members of the Institute. Before the arrival of Dr. Jones, Dr. Patterson volunteered to supply his place, and gave lectures on the strength, and stress of timbers. Mr. P. A. Browne gave lectures on the law of apprentice and master; Dr. Griffith on the diseases incident to mechanics and manufacturers; Dr. Darrach on the mechanism of the human frame; and, at the close of the season, Dr. Hare gave at his own room, lectures on electricity.

The audience at the lectures, was always numerous and attentive, and it is believed that this important and prominent department of the Institute, has not failed to prove eminently useful.

Still, it must be universally acknowledged, that to receive the full advantage of a course of lectures, requires a degree of preparatory instruction, and a maturity of age, which many of our auditors do not possess. The great and fundamental object for which we were established, namely, to improve the condition and elevate the character of the operative class of society, by affording them the only effectual means for this purpose, *education*, cannot be accomplished by lectures alone. To attain this object effectually, we must commence at an early age, and it should be our aim to give to the children of our mechanics and manufacturers, who are generally in but moderate circumstances, the advantages of education which have hitherto been confined to the children of the rich, and which have ever constituted the choicest boon that wealth could purchase for them.

Impressed with these views, the Board established, nearly two years ago, a school for mathematics, and one for drawing. But the schools are insulated, and do not constitute, as they ought, parts of a complete system of elementary education; and they have failed, from this cause, and, it is believed, from this cause alone, to fulfil the expectations which were formed at their commencement.

At present the necessity of adopting a more enlarged and perfect plan of education, in the Institute, seems to be universally felt; and accordingly at the meeting of the Board of the 6th of April, it was unanimously resolved, that it was expedient to extend the system of education according to the general outline of a plan reported by the Committee of Instruction; one of the leading features of which, is the establishment of a High School Department, in which the system of mutual instruction shall be introduced, and in which the elements of mathematics, drawing, geography, history, the Latin and Greek languages, and, when practicable, the French and Spanish, shall be taught.

As the details of this plan have not been fully digested and arranged, it is thought that it would be premature, at this time, to bring it more fully before the institute.

We have the satisfaction to state that the "Franklin Journal," to which, allusion has been made in our former reports, has been at length commenced, under the most favourable auspices. It is under the patronage of the Institute, but the editorship is entirely committed to the Professor of Mechanics, Dr. Thomas P. Jones. The first number was published in the month of January, and two other numbers have since appeared. It has hitherto given entire satisfaction to the Board, and it is believed to the members of the Institute, and the subscribers, generally. We sincerely hope that it may receive the continued, and increasing encouragement, which it so richly merits.

The Board, after much deliberation, have deemed it expedient to alter the time for the payment of the annual contributions, and have adopted the following resolutions, which they think it right to communicate to the Institute.

Resolved, That the annual payments from members of the Institute be hereafter due and payable on the third Thursday of October in each year.

Resolved, That on the third Thursday of October, the Treasurer be authorized to issue the tickets of those members who have already paid their subscription for 1826, upon the payment of one dollar and fifty cents, the ticket then issued to be current for one year thereafter.

Resolved, That the Treasurer be authorized to receive from all members who have not paid their subscription for 1826, and from all members who may be elected prior to 1st October, 1826, one dollar and fifty cents, being for a half year's subscription to that date, and for which he shall issue receipts.

Since the last quarterly report, forty new members have been added to the Institute.

The Treasurer's report herewith presented, exhibits the state of the funds of the Institute for the quarter just expired, by which it will be seen that 111 dollars and 50 cents have been received for life memberships, and 1158 dollars for annual contributions.

The whole amount received during the quarter was 3261 dollars and 1 cent, and the expenditures, including six months interest on the building loan, amounted to 2683 dollars and 74 cents; leaving a balance in the hands of the Treasurer, of 577 dollars and 27 cents.

All which is respectfully submitted.

By order, THOS. FLETCHER, Chairman.

Attest—

JNO. R. WARDER, Clerk of the Board.

Philadelphia, 20th April, 1826.

List of New Patents in England, which have passed the Great Seal, since Dec. 27, 1825.

To John M'Curdy, Esq. for certain improvements in generating steam. Dated Dec. 27, 1825.—To be specified in six months.

To James Oyston, and James Thomas Bell, watchmakers; who, in

consequence of a communication made to them, by a certain foreigner, residing abroad, are in possession of certain improvements, in the construction or manufacture of watches, of different descriptions. Dated Jan. 6, 1826.

To Richard Evans, coffee-merchant; for certain improvements in the apparatus for, and process of distillation. Dated Jan. 7, 1826.—In six months.

To Henry Houldsworth, jun. of Manchester, cotton-spinner; for certain improvements in machinery, for giving the taking up, on winding—on motion, to spools, or bobbins, and tubes, or other instruments, on which the roving or thread is wound, in roving, spinning, and twisting machines. Dated Jan. 16, 1826.

To Benjamin Newmarch, Esq.; for an improved method of exploding fire-arms. Dated Jan. 16, 1826.—In six months.

To John Rothwell, of Manchester, tape manufacturer; for an improved heald, or harness, for weaving. Dated Jan. 16, 1826.—In two months.

To Henry Anthony Koymans, merchant; who, in consequence of certain communications made to him, by a certain foreigner, residing abroad, is in possession of certain improvements in the construction and use of apparatus, and works, for inland navigation. Dated Jan. 16, 1826.—In six months.

To John Frederick Smith, Esq.; for an improvement in the process of drawing, roving, spinning, and doubling wool, cotton, and other fibrous substances. Dated Jan. 19, 1826.—In six months.

To William Whitfield, of Birmingham, for certain improvements in making or manufacturing of handles for saucepans, kettles, and other culinary vessels, and also tea kettle handle straps, and other articles. Dated Jan. 17, 1826.—In six months.

To Benjamin Cook, of Birmingham, for certain improvements in making or constructing hinges, of various descriptions. Dated Jan. 19, 1826.—In six months.

To Abraham Robert Corent, of Gottenburgh, in the kingdom of Sweden, merchant; at present residing in the city of London; for a method of applying steam, without pressure, to pans, boilers, coppers, stills, pipes, and machinery, in order to produce, transmit, and regulate various temperatures of heat, in the several processes of boiling, distilling, evaporating, inspissating, drying, and warming; and also to produce power. Dated Jan. 19, 1826.—In six months.

To Sir Robert Seppings, Knight, a commissioner and surveyor of our navy, of Somerset House, in the county of Middlesex; for an improved construction of such masts and bowsprits as are generally known by the names of made masts, and made bowsprits. Dated Jan. 19, 1826.—In two months.

To Robert Stephenson, engineer; for his axletrees to remedy the extra friction on curves to wagons, carts, cars, and carriages, used, or to be used, on rail-roads, railways, and other public roads. Dated Jan. 23, 1826.—In six months.

Erratum—in page 158, line 7; for weights, read heights.